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- Free Open-Source Solvers
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EURO BONN 2009
Sign up for your FREE copy of MPL at the Maximal Exhibit Booth
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FICO™ Xpress Optimization Suite

FICO™ Xpress Optimization Suite 7 brings a new level of power and speed to optimization. Solve your “unsolvable” problems with the optimization system that gives you real-time optimization for real-world challenges.

- Solve previously “unsolvable” problems through parallel computing, enabling you to solve the most difficult business problems up to 60% faster, and use real-time optimization on your most dynamic problems
- Take advantage of the improved Xpress-Mosel modeling language and development environment to increase your productivity—including a drag and drop editor for creating a graphical interface to model, allowing rapid prototyping and quick deployment
- Examine N-best optimal solutions to find the ideal choice for your business scenario

“Decision management is a critical function in our business, where we handle dynamic scheduling and resource allocation for nearly 250,000 passengers on some 4,000 flights every single day. We require a sophisticated modeling environment and need optimization solvers to be available to support the business. Xpress will allow us to meet today’s challenges and will provide us an innovative and flexible platform available for our future needs.”

—Armando Silva, Managing Director Operations Research, American Airlines

“We have a number of projects that will provide huge and verifiable economic benefits to our organization. We chose Mosel & Xpress over OPL & CPLEX because of the superior programming flexibility that Xpress Mosel provided our Development team. This fact, plus the superior performance of the solver, made the decision very easy. With Mosel’s intuitive language constructs, an extremely fast learning curve, easier integration and a more powerful language syntax; we were able to witness an immediate impact from our Development team. This, despite the fact that everyone on the team was new to Xpress Mosel. The bottom line—immediate cost savings for our organization because we were able to deploy our applications very quickly.”

—Clive Thomas, Manager of Nestlé Supply Chain Operations
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WELCOME

I am delighted to welcome you to EURO XXIII.

What a wonderful opportunity to enrich our social and intellectual capital in the historic and artistic city of Bonn. I would like to congratulate everyone involved in laying the foundations for what promises to be an excellent conference. It will be the third EURO conference in a row to attract a record breaking number of papers, for the first time exceeding 2000. EURO’s overarching objectives are to advance knowledge, interest and education in OR and this growth is encouraging evidence of continuing achievement. This is particularly so in the current challenging economic times – but may also be a reflection of the benefit that OR can bring to organisations in such a climate, helping them to define their core values, identify and achieve “value for money” and, as the conference theme reminds us, to create competitive advantage.

The conference is an opportunity for us to celebrate success. We will do this in many ways, such as the conferment of a range of EURO awards, including the new medal for distinguished service to EURO. However, the true success of the conference will be realised through the active participation of all of us – I hope that everyone will leave feeling personally enriched, I know that the discipline of OR will be.

Valerie Belton
President of EURO
Welcome

Dear participant,

Welcome to the EURO conference 2009. We are happy to have you here in Bonn!

The first meeting in this series took place in Brussels, way back in 1975. At that time the meeting consisted of 120 presentations that attracted 500 participants. A lot of time has passed since then, and the present conference is already the 23rd meeting in the series. And the conference has grown beyond all our expectations: This year we will have over 2000 presentations and over 2200 participants! This makes EURO’2009 by far the largest EURO conference ever, and we are proud to host far more than 800 Non-European delegates in Bonn. Because of this large number of delegates, the Programme Committee decided that regular sessions will be allotted 80 minutes (instead of the 90 minutes at previous conferences). Future organisers will have to find other solutions to create a pleasant schedule, and perhaps this is the right moment for extending the conference to a four-day-event.

Over the years the EURO conferences have not only grown with respect to volume. They also have expanded into new areas of application, and they have opened up into new research directions. For example: 20 years ago EURO still did not cover the area of computational biology. Or: 10 years ago EURO still did not cover the area of algorithmic game theory. This permanent development and permanent adaption to new challenges (we could perhaps also say: this preservation of favourable variations, and the destruction of injurious variations) is the principal factor of our strength, and it is the key to our future success.

The conference theme is OR creating competitive advantage, and a number of our keynote speakers will develop their ideas on this. Furthermore, you will find that several of the streams and many of the contributed talks are centered around this theme.

And finally we would like to thank you, dear participant, personally for your contribution in making this conference a big success. We hope that while you are experiencing the exciting atmosphere of this event, you will gain many new insights and learn about the fascinating new developments in Operations Research.

Have a pleasant stay in Bonn!

Erwin Pesch
Chair of the Organising Committee

Gerhard J. Woeginger
Chair of the Programme Committee
PROGRAMME AND ORGANISING COMMITTEE

Organising Committee

Chair:  
Erwin Pesch, University of Siegen, Germany

Co-Chair:  
Peter Letmathe, University of Siegen, Germany
Josef Jablonsky, University of Economics, Prague, Czech Republic
Florian Jaehn, University of Siegen, Germany
José P. Paixao, University of Lisbon, Portugal
Gerhard Wäscher, University of Magdeburg, Germany
Gerhard-Wilhem Weber, Middle East Technical University, Ankara, Turkey

Programme Committee

Chair:  
Gerhard Woeginger, University of Eindhoven, Netherlands

Horst Hamacher, Technical University of Kaiserslautern, Germany
Graham Kendall, University of Nottingham, United Kingdom
Bernhard Korte, University of Bonn, Germany
Jan Karel Lenstra, CWI Amsterdam, Netherlands
Ulrike Leopold-Wildburger, University of Graz, Austria
Silvano Martello, University of Bologna, Italy
Benny Moldovanu, University of Bonn, Germany
George Nemhauser, Georgia Institute of Technology, USA
Erwin Pesch, University of Siegen, Germany
Juan-José Salazar-González, University of La Laguna, Spain
Roman Słowiński, University of Poznan, Poland
Gerhard-Wilhelm Weber, Middle East Technical University, Ankara, Turkey
## OVERVIEW OF THE PROGRAMME

### Monday, July 6, 2009

<table>
<thead>
<tr>
<th>Start</th>
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<tr>
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<tr>
<td>15:20</td>
<td>16:10</td>
<td>Reinhard Selten</td>
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<td>Chair: Benny Moldovanu</td>
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<td>Room: Hall Maritim</td>
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<tr>
<td>16:20</td>
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<td>Christos Papadimitriou</td>
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<td>9:35</td>
<td>10:20</td>
<td>Noam Nisan</td>
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<td>Chair: Michel Gendreau</td>
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<td>Room: Hall Beethoven</td>
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<tr>
<td>10:20</td>
<td>11:05</td>
<td>Rainer Burkard</td>
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<td></td>
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<td>Chair: Ulrike Leopold-Wildburger</td>
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<td></td>
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<td>Room: Hall Schumann</td>
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<tr>
<td>11:20</td>
<td>12:40</td>
<td>Ramji Balakrishnan</td>
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<td>Chair: Peter Letmathe</td>
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<td>Room: Hall Reger</td>
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<td>12:55</td>
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<td>10:20</td>
<td>Toshihide Ibaraki</td>
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<td>Chair: Endre Boros</td>
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<td>10:20</td>
<td>11:05</td>
<td>Rolf Möhring</td>
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<td>Room: Hall Schumann</td>
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<td>11:20</td>
<td>12:40</td>
<td>Gideon Weiss</td>
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<td>Chair: Gerhard-Wilhelm Weber</td>
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<td>Room: Hall Reger</td>
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<td>Nitin Saxena</td>
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<td>15:15</td>
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<td>Edmund Burke</td>
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<td>Room: Hall Schumann</td>
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<td>16:15</td>
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<td>GOR Science Award</td>
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<td>Room: Hall Reger</td>
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<td>Closing Session, Room: Hall Beethoven</td>
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Audio/Visual Equipment
Every room is equipped with a desktop PC connected to a LCD projector. The computers contain up-to-date software for the main presentation formats (PowerPoint, PDF, PostScript) and have USB connections for memory cards. You can either use your laptop or transfer your presentation onto the desktop. Overhead transparencies will be provided as needed. Please make sure to arrive at your session at least ten minutes before its scheduled start. Before the session begins, all presenters should set up and test their presentation and the connection with the LCD projector.

Speaker Information
The location of your session is shown in the Abstracts section of the Conference Programme book. Please be on time for your session, check in with the session chair, and test the A/V equipment. Time your presentation to fit the allotted time (26 minutes for 3 speakers, 20 minutes for 4 speakers and 16 minutes for 5 speakers in a session), allowing time for questions and audience participation. Presentations should be limited to key issues with a brief summary. Feel free to bring along copies of your paper to distribute or to provide a handout with related information.

Session Chairs
The role of the chair is to ensure the smooth execution of the session. Make sure to:

- Contact the speakers before the session, to verify who will present and to pre-empt any technical problems.
- Begin the session on time. Each session lasts 80 minutes, with equal time allotted for each presentation in the session.
- Keep presentations in the order shown in the programme, to allow participants to jump between sessions.
- Introduce the speaker and the title of each presentation.
- Express visually to the speaker how many minutes (10, 5, 2) are left, using either your hands or prepared cards.
- Ensure that the presentations, including questions, do not overstep their time frame (26 minutes for 3 speakers, 20 minutes for 4 speakers and 16 minutes for 5 speakers in a session).
- At the end of each presentation ask for questions and thank the speaker.

This information is valid as of June 5, 2009.
High-Level Modeling

The General Algebraic Modeling System (GAMS) is a high-level modeling system for mathematical programming problems. GAMS is tailored for complex, large-scale modeling applications, and allows you to build large maintainable models that can be adapted quickly to new situations. Models are fully portable from one computer platform to another.

Wide Range of Model Types

GAMS allows the formulation of models in many different problem classes, including

- Linear (LP) and Mixed Integer Linear (MIP)
- Quadratic Programming (QCP) and Mixed Integer QCP (MIQCP)
- Nonlinear (NLP) and Mixed Integer NLP (MINLP)
- Constrained Nonlinear Systems (CNS)
- Mixed Complementary (MCP)
- Programs with Equilibrium Constraints (MPEC)
- Conic Programming Problems
- Stochastic Linear Problems

Scheduling and Planning at BASF

Close cooperation between logistics, information services and the scientific computing group of BASF, several academic institutions, SAP AG, and Mathesis GmbH led to a number of successfully deployed applications based on exact and hybrid optimization techniques. One of the results is a novel modeling approach of batch and continuous plants:

- State-task network formulation resulting in mixed-integer linear programs
- Hybrid methods and decomposition schemes to handle large instances
- Tight lower bounds derived from auxiliary models
- Implementation in GAMS with parallel GAMS/CPLEX
- New interfacing technology and integration approaches to connect to SAP-APO
- Used on a daily basis to improve planning and scheduling

State-of-the-Art Solvers

GAMS incorporates all major commercial and academic state-of-the-art solution technologies for a broad range of problem types, including global nonlinear optimization solvers.
GENERAL INFORMATION

Conference Venue

The conference will take place in the Gustav-Stresemann-Institut and the Maritim Hotel in Bonn. Both are located in the governmental quarter of Bonn and are within a short walking distance.

Conference Addresses

Gustav-Stresemann-Institut, Langer Grabenweg 68, 53175 Bonn, Phone: +49(0)228 / 81 07-0, www.gsi-bonn.de
Maritim Hotel, Godesberger Allee, 53175 Bonn, Phone: +49(0)228 / 81 08-0, www.maritim.de
To whom it may concern: Wissenschaftszentrum Bonn, Ahrstraße 45, 53175 Bonn, Phone: +49 (0)228 / 302-0, www.stifterverband.org

Registration Desk

The registration desk will be located in the foyer (ground floor) of the Maritim Hotel. We recommend picking up your registration material as soon as you arrive on Sunday to avoid queues on Monday morning.

Opening Hours of the Registration Desk:
Sunday  12:00 - 19:00
Monday  08:00 - 18:00
Tuesday  08:00 - 17:00
Wednesday 09:00 - 14:00

Registration Fee, Badges

Registration is required for all participants and exhibitors. Registered participants and exhibitors will receive a badge giving them access to the conference venue. Participants and exhibitors are requested to wear their badge visibly at all times.

The registration fee for a full delegate covers the following:
- Participation in all sessions
- Access to the poster area and the technical exhibition during the EURO Conference
- Conference materials (Final Programme, Book of Abstract)
- Welcome Reception in the Restaurant “Rheinaue” (beer garden, Sunday, July 5, 19:00 - 23:00)
- Concert and Reception in the Beethoven Hall (Monday, July 6, 19:45 - 23:00)
- Coffee breaks
- Lunches
- Ticket for the public transportation system
GENERAL INFORMATION

The registration fee for an accompanying person covers the following:

- Welcome Reception in the Restaurant “Rheinaue” (beer garden, Sunday, July 5, 19:00 - 23:00)
- Concert and Reception in the Beethoven Hall (Monday, July 6, 19:45 - 23:00)
- Lunches
- Sightseeing tour of the city Bonn (please contact the registration desk for details)
- Ticket for the public transportation system

Please note that the conference dinner is not included in the registration fee.

Internet Access
Details about free Internet access were not available to us when the Book of Abstracts went to press. Both the Maritim Hotel and the Gustav-Stresemann-Institut offer so called “Hot Spots” Internet access points for a reasonable fee.

Language
The official language will be English. No simultaneous translation will be provided.

Lunches
Lunch will be served in the Gustav-Stresemann-Institut and the Maritim from 11:30 to 14:00. Tickets are required for lunch, which can be found in your bags. Every ticket shows you the day and location where you may have lunch. At all days and both places there is also a vegetarian dish available.

Banks and Money
Official banking hours in Bonn are between 9:00 and 16:00 from Monday to Friday. All banks in Germany exchange foreign currency. The currency unit in Germany is the Euro (€, EUR), which is subdivided into 100 Cents (Cent). German banks have agreed on a standard debit card called “Maestro Card”. These cards are far more accepted than credit cards, which might not be accepted for payment in some shops or restaurants. ATM machines and exchange offices are easily available. Most ATMs will allow you to withdraw money with your credit card or your foreign debit card, but you will need to know your card’s PIN for that.

Electricity Network
Germany uses a 230 volt 50 Hz system, sockets have the European standard and plugs have two circular metal pins. To use electric appliances from your country you may need a special voltage converter with an adapter plug.

Useful Telephone Numbers
The country code for Germany from overseas is +49.

First Aid:  112
Police:     110
Taxi Bonn: +49(0)228 / 55 55 55
FLOOR PLANS: GUSTAV-STRESEMANN-INSTITUT (GSI)
FLOOR PLANS: MARITIM HOTEL
Public Transportation

Bonn has an extensive public transport system that includes bus, tram, and U-Bahn (underground system). The underground system operates till 1:30. After that, the system of night trams and night buses is in operation with different numbers and lines than during the day. Tickets for the bus, tram, or underground can be purchased from vending machines, ticket offices, or in rail stations. Bus tickets can also be purchased on board. Tickets come in a variety of denominations, including daily, weekly, and monthly tickets.

Ticket for the Public Transportation System

Each conference participant will receive a ticket for the public transportation system (bus, tram, and U-Bahn) with the conference material. The ticket is valid from Sunday to Wednesday for the cities Bonn, Siegburg, St. Augustin, Königswinter, and Bad Honnef. The bus SB60 to the airport Köln/Bonn is also free of charge. The transportation ticket is non-transferrable and has to be signed by the card holder before the first trip.

Connections to the Conference Venue

The direct connection from Bonn central underground station to the conference venue (station Robert-Schumann-Platz):

- Line 66, direction Bad Honnef / Königswinter

The direct connection from Bonn central underground station to the conference venue (station Deutsche Telekom / Platz der Vereinten Nationen):

- Line 16, direction Bad Godesberg
- Line 63, direction Bad Godesberg
- Line 66, direction Bad Honnef / Königswinter

Social Events

Welcome Reception in the Restaurant „Rheinaue“

The Welcome Reception will take place in the Restaurant “Rheinaue” (beer garden) on Sunday from 19:00 to 23:00. The restaurant is within a short walking distance from the conference venue. From the entrance of the Maritim hotel continue straight across the Robert-Schumann-Platz and cross the Ludwig-Erhard-Allee using the pedestrian bridge. When you enter the park the restaurant is on your left side. The location of the restaurant is also marked on the map that is displayed in the Restaurant section on page I14.

Address: Restaurant „Rheinaue“, Ludwig-Erhard-Allee 1, 53175 Bonn, Phone: +49(0)228 / 37 40 30

Concert and Reception in the Beethoven Hall

On Monday there will be a Concert and a Reception in the Beethoven Hall from 19:45 to 23:00 (see map on page I13). The Concert will start at 20:30 and you are requested to be on time.

Programme:

Ludwig van Beethoven - Klavierkonzert Nr. 2 B-Dur op. 19
Ludwig van Beethoven was born in Bonn in 1770. The initial ideas for the composition of the 2nd piano concerto began in Bonn. Beethoven himself often performed his own piano concerto in Vienna.

Franz Schubert - Symphonie Nr. 5 B-Dur D 485
The 5th Symphonie of Schubert is much in the tradition of Beethovens compositions. Schubert composed the opus at the age of 19 years. Particularly impressive is the youthfull freshness of this symphonie.

Address: Beethoven Hall, Wachsbleiche 16, 53111 Bonn, Phone: +49(0)228 / 72 22-0, www.beethovenhalle.de

Tram / Underground Connection:

The direct connection from the conference venue (station Robert-Schumann-Platz or station Deutsche Telekom / Platz der Vereinten Nationen) to the Beethoven Hall (station Bertha-von-Suttner-Platz / Beethovenhalle):

- Line 66, direction Siegburg central station
SOCIAL EVENTS

Conference Dinner
The conference dinner will be held on Tuesday evening 18:30 - 23:00 on the “RheinEnergie” boat on the river Rhine. The boat will depart at 20:00 and return at 23:00.

Tram / Underground Connection: The direct connection from the conference venue (station Robert-Schumann-Platz) to the conference dinner (station Juridicum):
• Line 66, direction Siegburg central station

The direct connection from the conference venue (station Deutsche Telekom / Platz der Vereinten Nationen) to the conference dinner (station Juridicum):
• Line 63, direction Tannenbusch Mitte
• Line 66, direction Siegburg central station
• Line 16, direction Niehl Sebastianstraße
RESTAURANTS

Recommendations
Halbedel's Gasthaus, Rheinallee 47, 53173 Bonn, Phone: +49(0)228 / 35 42 53
Restaurant Rheinaue, Ludwig-Erhard-Allee 1, 53175 Bonn, Phone: +49(0)228 / 37 40 30

Restaurants near the Conference Venue
Bachmann's Restaurant, Annaberger Straße 108, 53175 Bonn, Phone: +49(0)228 / 31 12 96
China Restaurant, Godesberger Allee 125, 53175 Bonn, Phone: +49(0)228 / 37 53 00
Friedsdorfer Hof, Bernkasteler Strauss 46, 53175 Bonn, Phone: +49(0)228 / 31 67 58
Pizza International, Annaberger Straße 72, 53175 Bonn, Phone: +49(0)228 / 35 28 00
Pizzeria da Roberto, Brandenburger Straße 2a, 53175 Bonn, Phone: +49(0)228 / 37 16 70
Restaurant Indian Palace, Gotenstraße 126, 53175 Bonn, Phone: +49(0)228 / 37 28 597
Sushi Paradies, Annaberger Straße 102a, 53175 Bonn, Phone: +49(0)228 / 93 19 9577
TAO Bar & Restaurant, Mildred-Scheel-Straße 1, 53175 Bonn, Phone: +49(0)228 / 37 28 289

Note that tipping is regular practice and 5-10% is the usual rate, depending on service and satisfaction.
MUSEUMS

Bonn is a "city of museums". The so-called "Museumsmeile", the cultural centre with several museums, is at walking distance from the conference venue.

Arithmeum
Lennéstraße 2, 53113 Bonn, Phone: +49(0)228 / 73 87 90, www.arithmeum.uni-bonn.de
The Arithmeum displays the world’s largest collection of original mechanical calculators, computers, chips, and historical arithmetic books. The visitors experience an extraordinary unity of technology and aesthetics which is achieved by the architecture and the exhibition design.

Art and Exhibition Hall of the Federal Republic of Germany
Friedrich-Ebert-Allee 4, 53113 Bonn, Phone: +49(0)228 / 91 71-200, www.bundeskunsthalle.de
There is a large spectrum of temporary exhibitions at the Art and Exhibition Hall not only on art but also on cultural history, technology, and science. Since it was opened in 1992 there have already been more than 100 different exhibitions in these areas. There are also lots of cultural events, e.g. concerts, discussions, symposiums, and open-air concerts.

Beethoven Haus (Beethoven House)
Bonngasse 20, 53511 Bonn, Phone: +49(0)228 / 98 175-25, www.beethoven-haus-bonn.de
The city of Bonn is inseparably linked with Beethoven. His birth place, the "Beethoven Haus", which is a museum now, contains a large collection of authentic documents demonstrating Beethoven's life and work as an artist and musician. Furthermore, there are a Beethoven memorial, the Beethoven-Orchestra, and also a hall dedicated to him.

Bonn Museum of Modern Art
Friedrich-Ebert-Allee 2, 53113 Bonn, Phone: +49(0)228 / 77 62 60, www.bonn.de/kunstmuseum
The museum presents most important collections of modern German works of art and has become a forum for contemporary art in Germany. There are also classical modern works of art, e.g. by August Macke and Max Ernst.

Deutsches Museum Bonn (German Museum Bonn)
Wissenschaftszentrum, Ahrstraße 45d, 53175 Bonn, Phone: +49(0)228 / 30 22 54, www.deutsches-museum-bonn.de
The German Museum is the first museum for contemporary research and technology in Germany. It presents ground-breaking discoveries by Nobel-prize winners and many other top technical achievements that have taken place in Germany since 1945. These include the Fischer dowel and the computer chip, as well as procedures from the field of medical technology and brain research methods.

Frauenmuseum (Women’s Museum)
Im Krausfeld 10, 53111 Bonn, Phone: +49(0)228 / 69 13 44, www.frauenmuseum.de
Founded in 1981, the Women’s Museum aims to promote women’s art, culture and science.

Haus der Geschichte (House of History)
Willy-Brandt-Allee 14, 53113 Bonn, Phone: +49(0)228 / 91 65-0, www.hdg.de
The permanent exhibition of the House of History is dedicated to the contemporary history of Germany from the end of the Second World War to the present day. The museum presents political, economic and social history, living conditions of the everyday life, as well as important aspects of art and culture.

Zoological Research Museum Alexander König
Adenauerallee 160, 53113 Bonn, Phone: +49(0)228 / 91 22 211, www.museumkoenig.de
This Zoological Research Museum is one of Germany’s largest and most important natural history museums. Exhibitions with more than 3000 exhibits provide a fascinating insight into the diversity of the animal world.

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OPENING SESSION AND CLOSING SESSION

Opening Session
The session starts with the Anthem of Europe “Ode to Joy”, which has been composed by Beethoven who was born in Bonn. The President of the EURO, Valerie Belton will then follow by welcoming the participants to the conference and by giving a short presentation aimed particularly at the members of the Member Societies of EURO. Afterwards, the mayor of Bonn will give a warm welcome to all participants and the President of the GOR (the German Operational Research Society), Horst Hamacher will give a short presentation about the GOR and its activities.

Next, awards are to be announced. First, the winner of the GOR Science Award and the winners of the GOR Doctoral Dissertation Award are presented. Afterwards, the finalists of the EURO Doctoral Dissertation Awards are announced. Then the winner of EURO Distinguished Service Award (EDSM) is presented. Next the highest distinction of the Association of European Operational Research Societies – the EURO Gold Medal – will be presented and awarded. The laureate will give a plenary presentation after the interlude from Nadine Uebe-Emden, who will sing “One moment in time”.

Finally, the chairs of the Organising and the Programme Committee will present the latest information concerning the conference.

Closing Session
Three prizes will be awarded in the closing session. The EURO Excellence in Practice Award (EEPA), the EURO Doctoral Dissertation Award (EDDA), and the EURO Management Science Strategic Innovation Prize (MSSIP) will be announced. Next, the special journal issues organised around EURO will be announced, in particular the special issue of EJOR. Afterwards there will be a presentation of the ROADEF challenge, an OR challenge dedicated to industrial applications.

Gerhard Woeginger, the Chair of the Programme Committee will next give a summary of the conference, followed by brief introduction of the future OR conferences IFORS and EURO by their organisers. Valerie Belton, the president of EURO will finalize the business matters and Erwin Pesch will say ‘farewell’ to the conference participants.
EURO AWARDS AND PRICES

EURO Gold Medal
The EURO Gold Medal is the highest distinction within OR in Europe. It is conferred to a prominent person or institution, for an outstanding contribution to the Operational Research science. The award, which officially is bestowed in conjunction with a EURO Conference, is not only a significant honor for the laureate personally, but also important for the general promotion of OR as leading scholars and their contributions are made better known via the Medal. Laureates of the EURO Gold Medal are invited to all future EURO Conferences without payment of the registration fees.

Nominations of candidates are solicited from national societies in year prior to each EURO conference. To emphasize the European flavor of the award, all societies are strongly urged not to propose a candidate from their own country. The societies are responsible for providing a recent and detailed CV of their nominee, as well as written motivation stating the reasons why their nominee deserves the EURO Gold Medal. The jury evaluates the proposed candidates essentially on basis of their scientific activities (papers in excellent journals, editorials, jobs, number of PhD students). The proposed laureate should also have contributed to the promotion of OR, in particular in Europe.

The EURO Gold Medal will be awarded at the opening session in the Maritim hall and the laureate(s) will give a speech.

EURO Excellence in Practice Award (EEPA 2009)
The EURO Excellence in Practice Award 2009 is awarded for an outstanding application of Operational Research in practice. The nominated works will be presented during the sessions TE-01 and TF-01. The price will be awarded at the closing session in the Beethoven Hall (Maritim Hotel).

EURO Management Science Strategic Innovation Prize (MSSIP 2009)
EURO is offering the Management Science Strategic Innovation Prize to foster specific areas of application of Operational Research in management. The prize is intended to award outstanding contributions in theory or in practice to a well-chosen scientific area encouraging innovative researchers and possibly entire research groups to focus their work on a domain of particular strategic interest.

EURO Distinguished Service Medal
The EURO Distinguished Service Medal is awarded for recognition of distinguished service to the Association of European OR Societies (EURO) and to the profession of OR. The award will be officially delivered at the opening session.

EURO Doctoral Dissertation Award (EDDA 2009)
The EURO Doctoral Dissertation Award, a new EURO instrument will now be awarded each time a EURO-k conference takes place. It will be awarded for the third time at the closing session of the EURO 2009 conference. The nominated doctoral students will present their research during the session TD-01.

Additionally, the German Operational Research Society (GOR) will award three prices. The laureates of the GOR Science Award, the GOR Doctoral Dissertation Award, and the GOR Diploma / Master Thesis Award will present their works during the sessions WE-03, WC-06, and WD-06, respectively.
Besides more than 2,000 presentations covering all areas of OR, keynote talks of world-class speakers will provide outstanding reviews and knowledge on their current research fields.

**Experimental Results on the Process of Goal Formation and Aspiration Adaptation**

**Reinhard Selten** (Nobel Prize in Economics 1994, University of Bonn)

**Abstract:** We experimentally investigate how subjects deal with a multi-period planning and decision problem. The context is a profit maximization task in a computer-simulated monopoly market over fifty time periods. Subjects have to form vectors of goal variables. A goal variable is an arithmetic expression involving short term feedback variables like profit, sales or quality. An aspiration level is a vector of numerical values for the goal variables. The subjects are provided with a computerized planning tool allowing them to check feasibility of any aspiration level. We present results regarding, first, the selection of goal variables and, second, the process of aspiration adaptation. As to the first, we find that aspiration levels tend to be changed in strong agreement with basic principles of Aspiration Adaptation Theory (Sauermann and Selten 1962, Selten 1998, 2001). In addition, we find that in many cases the process of aspiration adaptation leads into a nearly stationary situation in which the aspiration level is approximately reproduced by a subject over several periods. Some subjects who reach a nearly stationary situation explore for a more profitable nearly stationary situation. Those subjects who reach a nearly stationary situation tend to be more successful and more goal persistent than those who do not. This is a joint work with Sabine Piltzauer and Martin Hohnisch.

**Using Allocated Costs for Decision Making: Reconciling Theory with Practice**

**Ranji Balakrishnan** (University of Iowa)

**Abstract:** Firms spend considerable resources in devising product costing systems. These systems divide up a firm’s capacity costs (e.g., the cost of machinery and buildings) into pieces attributable to individual products and customers. Overwhelming evidence shows that managers worldwide use allocated costs for making product pricing and capacity planning decisions. For example, firms routinely drop product lines that do not recover their full (allocated) cost. Economists question this practice. They argue that the costs being allocated are irrelevant to a decision making perspective. I aim to summarize recent research that seeks to reconcile theory with practice, and offer avenues for additional work. The core idea of this research stream is the notion that a firm’s product- and capacity-planning problems are computationally complex. A conceptually correct formulation is multi-period stochastic optimization problem with complex linkages across periods (e.g. inventory) and constraints (e.g., multiple resources used by the same product). Accounting researchers argue that this problem is not solvable. They argue that the product cost data can serve as economically sufficient statistics that permit problem decomposition. Such decomposition would permit managers to deal with pricing problems that pertain to individual products and planning problems that deal with each customer. As far as I know, this research stream is relatively unexplored. We have examined questions under which such problem decomposition is costless and problem features that lead to a loss. Even when product cost is not economically optimal, it is reasonable to think of it as a heuristic that aids “local” decision making. This view reflects the magnitude of the economic loss from using heuristics, as well as methods for improving our estimate. In particular, it is of interest to examine the sources of error (e.g., model specification, aggregation and/ or measurement) and their implications for the accuracy of product costs. Simulations play a significant role in this research stream that has considerable practical appeal. Finally, current research has begun to examine questions of how the robustness of product solutions to the error in the estimates.

**New Cutting and Packing Methodologies and their Commercial Application**

**Edmund Burke** (University of Nottingham)

**Abstract:** This talk will present an overview into research conducted by the Automated Cutting and Packing Group at the University of Nottingham. We have developed cutting and packing methodologies that have been implemented within a range of commercial applications. As a direct result of this work we have founded a spin-out company, Aptia Solutions Ltd, to further develop and commercialise these algorithms and the talk will conclude by discussing some of the commercial issues facing this research area.

**Computing Equilibria**

**Christos Papadimitriou** (FORS distinguished lecturer, University of California at Berkeley)

**Abstract:** The existence theorems establishing that certain equilibria, such as the mixed Nash equilibrium and price equilibria, are guaranteed to exist under very general conditions, are some of the most reassuring results in Economics. Developing efficient algorithms for computing these equilibria— that is, rendering these existence theorems constructive— has been over the past decades a most important research front, which however has met with very limited success. In recent years, a new kind of complexity theory has been developed and applied to establish that certain of these computational problems are intractable, thus explaining the lack of progress in the development of efficient algorithms for them. These new results raise important new questions related to efficient algorithm for computing approximate equilibria, not unlike the way in which the theory of NP-completeness for combinatorial optimization problems in the 1970s led researchers to the exploration of approximation algorithms. In this talk I shall survey these complexity results, as well as a few recent algorithmic advances.

**Assignment Problems**

**Salvatore Greco** (University of Catania)

**Abstract:** Assignment problems (AP) are classical OR problems which occur in many application areas. In the classical AP, there are two sets of agents that need to be matched on a one-to-one basis. AP can be formulated within this framework.
Problem Solving by General Purpose Solvers
Toshihide Ibaraki (Kwansei Gakuin University)

Abstract: To solve problems abundant in real world applications, we have been proposing an approach of using general purpose solvers, since we cannot afford to prepare special purpose algorithms for all individual problems. For this, we have developed general purpose solvers for several standard problems such as CSP (constraint satisfaction problem), RCPSP (resource constrained project scheduling problem) and VRP (vehicle routing problem), among others. Their algorithms are all based on metaheuristics which utilize local search as their core. The solvers have been successfully applied to many applications. In this talk, we report some of our recent experiences, including those for ITC2007 (International Timetabling Competition) and other industrial applications.

2-Dimensional Packing Problems in Telecommunications
Andrea Lodi (University of Bologna)

Abstract: We consider 2-dimensional packing problems arising from telecommunication applications. In particular, according to WIMAX technology, information is sent to several users within the same frame, and an efficient and fast way to send information and to recover it is required. This leads to interesting 2-dimensional packing problems for which different objective functions can be defined. For a simplified version of the real-world problem we provide an approximation algorithm and different fast heuristics, which have been put to be effective in practice. Finally, computational experiments on a set of real-world instances are presented.

Routing in Graphs with Applications to Material Flow Problems
Rolf Möhring (University of Technology, Berlin)


Google's auction for TV ads
Noam Nisan (Hebrew University)

Abstract: The talk will describe the auction system used by Google for allocation and pricing of TV ads. The auction is based on a simultaneous ascending auction, and has been in use since September 2008.

Conic programming relaxations for combinatorial optimization
Franz Rendl (University of Klagenfurt)

Abstract: The success of interior point methods in the 1990's to solve semidefinite programs (SDP) has spurred the interest in SDP as a modelling tool in various mathematical fields. In the context of combinatorial optimization, it turned out that SDP is particularly effective, if the underlying 0-1 formulation of the problem involves quadratic terms. In this talk, several SDP relaxations of NP-hard combinatorial optimization problems will be discussed. We also address relaxations based on the cone of completely positive matrices and other recent tools. These relaxations can be used either theoretically, to get approximations with an a priori upper bound on the error. They can also be used computationally to solve the underlying problem to optimality. Some recent developments in both directions will be presented. These cover Max-Clique, Graph Coloring and other Graph partition problems. The resulting SDP are typically of sizes, not accessible by interior point methods. We therefore also discuss some very recent algorithmic developments to solve these relaxations.

ELECTRE Methods: Main Features and New Developments
Bernard Roy (EÜCRO Gold Medal 1952, University Paris-Dauphine) and José Rui Figueura (Technical University of Lisbon)

Abstract: After a brief description of the constructivist conception in which ELECTRE method is inserted, we shall present the main features of these methods. They include elements such as, the possibility of modeling by taking into account positive and negative reasons, without any recording of data; thresholds used to take into account the imperfect knowledge of data; absence of systematic compensation between "gains" and "losses". The main weaknesses will also be presented. Then, some aspects related to new developments will be presented. They are related to new methodological tools, new procedures, axiomatic, and many other aspects. Finally, some concluding remarks will be outlined.

Prime Numbers and Circuits
Nils Puchner (Goedel Prize 2006, Fullkerson Prize 2006, University of Bonn)

Abstract: Prime numbers are not only fundamental mathematical objects but also have real world applications in cryptography. But the question of efficiently distinguishing primes from the composites was fully resolved only in 2002. We will review this deterministic polynomial time primality test (colloquially called the AKS primality test).

This solution relates to more general questions about circuits which we will briefly survey.

Sports Scheduling and Advances in Integer and Constraint Programming
Michael Trick (Carnegie Mellon University)

Abstract: Advances in sports scheduling methods are changing how professional and amateur schedules are created. Leagues around the world are using optimization and related approaches for their team and officials scheduling. I will give some experiences in scheduling real sports leagues and outline why I believe the major trends in optimization that are making it easier to create high quality schedules. My experiences come from leagues that range from a local children's football (soccer) league to scheduling the 2430 games that make up a single year's schedule for the US Major League Baseball. Computational methods from ten years ago are insufficient to attack these problems, even on today's computers, but recent advances in integrating integer and constraint programming, large neighborhood local search, and variable redefinition create powerful, flexible solution methods.

Combinatorial Optimization in Chip Design
Gian-Sera Stiebitz (University of Hannover)

Abstract: Chip design is one of the most fascinating application areas of mathematics. The rapid technological development, exponentially growing instance sizes, and the computational complexity of the key problems are posing continuous challenges to research. In particular, recent advances in combinatorial optimization have lead to substantially improved algorithms used in industry, and hence to better chips. We give some examples of this most fruitful interaction between theory and application, illustrating the variety of problems and techniques. Topics include partitioning, routing, resource sharing, and facility location.

Optimal Control of Manufacturing Systems: Solution of Fluid Approximation and Tracking by Queueing Model
Gideon Weiss (University of Haifa)

Abstract: We consider the optimal control of a large manufacturing system, over a finite time horizon, e.g. a semiconductor wafer fabrication plant. We model this as a multi-class queueing network, and approximate the queueing network by a fluid network, and obtain an optimal fluid solution by solving a separated continuous linear program (SCLS). To track this fluid solution we model the deviations of the real system from the fluid solution by a multi-class queueing network with infinite virtual queues (IQV). By keeping these deviations stable we obtain an asymptotically optimal control policy. We shall explain our motivation and the main features of this approach. We will then introduce the two themes of which it is based: A novel simplex like algorithm for the solution of SCLS, and the modeling device of IQVs. While this talk combines ideas from Manufacturing, Optimization and Queueing, it will be accessible to a wide audience of EURO members.
LIST OF MAIN STREAMS

Continuous Optimization and Control
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Data mining, Knowledge Discovery, Artificial Intelligence
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DEA and Performance Management
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Decision Analysis, Decision Support Systems, Modelling Languages
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Discrete Optimization, Graphs & Networks
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Financial Modelling, Risk Management, Banking
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Game Theory, Mathematical & Experimental Economics
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Multiple Criteria Decision Making, Optimization & Group Decision
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Agent-Based Modelling  
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Analytic Hierarchy Processes, Analytic Network Processes  
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Application of Fuzzy Logic & Real Options to Corporate Management and  
Decision-Making  
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Combinatorial Optimization  
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Complexity and Optimization  
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Computational Biology, Bioinformatics and Medicine  
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Experimental Economics and Game Theory  
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Evolutionary Multi Objective Optimization  
Jorgen Branka, (jbr@aalb uni-karlsruhe.de)
GROUP MEETINGS AND WORKSHOPS

Meeting of the members of the German OR Society, GOR (only for members of GOR !)
12. Mitgliederversammlung der GOR


Optimization Modeling with MPL/MOPS
Bonn, July 5, 2009, 12:30 - 15:00, ROOM S29 (Gustav-Stresemann-Institut)

The workshop focuses on how to build optimization models that can be used to solve real-world business problems. By the end of the seminar, the participants will know how to develop their own optimization models in MPL, link them to data sources and solve the models using state-of-the-art optimization solvers. Participants will also acquire a good working knowledge on how to embed optimization models into applications.

By attending this seminar you will learn how to:
• Identify the best use of optimization techniques & how to deploy them
• Prepare and import data from different sources for optimization
• Identify which solvers works best for your optimization problem
• Gain a realistic view on the use of optimization for business
• Build your own embedded optimization applications

The speakers will take you through all the steps of an optimization project using software tools from Maximal Software, MOPS, IBM-ILOG, GUROBI, and ARKI Consulting amongst others.

Workshop Schedule
• Introduction to Optimization Modeling and Solving
• Formulating Optimization Models in MPL
• Introducing MOPS Solver and MOPS Studio
• Introducing Open-Source CoinMP Solver
• Connecting to Databases and Spreadsheets
• Embedding Optimization in Applications
• Achieving Optimal Solution Performance
• Recent News and Trends in Optimization

For more details please go to www.maximalsoftware.com/seminar/BonnJul09

GAMS Workshop
Bonn, July 5, 13:30 - 17:00, Room S30 (Gustav-Stresemann-Institut)

We are happy to invite you to our GAMS workshop at the EURO 2009 in Bonn. The half-day workshop on Sunday is designed to demonstrate the GAMS modeling system together with its productivity tools. There will be a general introduction to the system and a presentation of GAMS’ key concepts and recent enhancements. The major part of the workshop consists of hands-on exercises building GAMS models and applications. Guided by our experts you will build sample optimization models from scratch. We will show how easy and flexible GAMS interacts with other applications including MS Office using GDX facilities and tools.

Please bring along your laptop for the hands-on exercises. In order to get started right away, please download the current GAMS Distribution from the GAMS Download Page www.gams.com/download/

AIMMS User Meeting
Bonn, July 5, 15:30 - 17:00, Room S5 (Gustav-Stresemann-Institut)

All current and prospective users of the AIMMS mathematical modeling system are invited to participate in this meeting. Come along to hear about the newest AIMMS features and development plans, to provide your feedback, and to meet other AIMMS Users.
GROUP MEETINGS AND WORKSHOPS

Pre-conference workshop at EUROXXIII, “Advances in Xpress”
Bonn, July 5, 13:00 - 17:00, Room S25 (Gustav-Stresemann-Institut)
This half-day workshop is aimed at academics and practitioners in OR who would like to learn more about how to analyze and improve their models, or see which possibilities there are to implement problem-specific solution algorithms, in particular using recent features of the modeling environment Mosel, the Xpress-Optimizer and other solvers of the Xpress product suite.

Workshop Programme
Part 1: Overview of new features
- Optimizer
  - advances in MIP solving
  - new parallel root heuristics
  - branching on split disjunctions
  - zero-half cuts
  - extended node-to-node presolve
  - improved simplex, barrier solvers and improved NLP support
  - new and improved solvers for solving quadratic constraints and objectives
- Mosel
  - multiple problem handling
  - indicator and logical constraints
  - automatic transformation of data structures
  - various other additions with tips and tricks for getting the best out of them
- Kalis
  - linear relaxations within Constraint Programming
- Other products
  - new look IVE
  - XAD editor
  - new BCL features
Part 2: Tutorial on modeling and solving optimization problems with Xpress-Mosel

GTS Workshop “An Introduction to Vehicle Routing and Network Planning with the Decision Support System TransIT”
Bonn, July 7, 08:00 - 9:20, Room S1 (Gustav-Stresemann-Institut)

7th EUROPT Workshop “Advances in Continuous Optimization”
Remagen, Germany, July 3-4, 2009
This workshop aims to bring together researchers from continuous optimization and from related fields of discrete optimization, operations research, economy and technology. It intends to be a forum for the exchange of recent scientific developments and for the discussion of new trends. The scope of the conference includes all aspects of smooth and nonsmooth optimization from fundamental research to numerical methods and applications.
For more information, please visit the workshop webpage www.rheinahrcampus.de/Home.europt2009.0.html.

Workshop on OR for Developing Countries - Young Researchers and PhD Symposium
Remagen, Germany, July 4, 2009
The aim of the Workshop is to provide a forum for doctoral students and others involved in OR and Development to share and discuss their research activities, encourage students to establish and maintain a research network, and to foster a research environment to support career development in any domain of a practical OR discipline. On a wider basis the workshop will demonstrate the value of collaborative research in the OR field, and explore the merits of an interdisciplinary approach to OR research.
For more information, please visit the workshop webpage www2.ing.puc.cl/~fcrespo/eurofdv/Bonnconference/home-page.htm.

State of the art workshop
Mutual session of special researchers of several EURO working groups OR and Development, Ethics, Decision making, Methodology of Societal Complexity and others organized by Prof. Dr. Doriem DeTombe, Prof. Dr. Cathal Brugha, and Prof. Dr. Gerhard-Wilhelm Weber.

Workshop related to EURO XXIII / EUROPT / EURO ORD
Remagen, July 5, 10:00 - 13:00
During the conference there will be a software and book exhibition in the foyer of the Maritim Hotel.

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Maximal Software has decided to give away a FREE perpetual license of the MPL Modeling System to every registered participant at the EURO 2009 Bonn Conference! To sign up for your free copy, or just to find out why we are now giving away development copies of our MPL software, please come visit us at our booth during the conference, or attend our pre-conference Workshop on Sunday at 12:30 - 15:00pm, or attend our MPL software session on Tuesday (TD-42).

Maximal Software is the developer of the MPL Modeling System, an advanced modeling language for formulating optimization models. MPL is one of the fastest and most scalable modeling languages on the market, and with the OptiMax Component Library add-on can be used to build customized end-user applications to solve real-world optimization problems.

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GTS Systems and Consulting GmbH offers systems and consulting services related to the optimisation of supply chains and transport networks. At the Euro meeting we present the latest version of our vehicle routing and scheduling system TransIT. The academic version of TransIT has an open service-oriented optimisation interface, comes at a strongly reduced price and can be used for both teaching and research.
patterns obtained using this approximation are close to optimal

depots. Computational experiments show that the plant opening

periods. Routing costs are approximated through trees rooted at the

cilities fixed for a long period remain fixed during several short pe-

routes are modified more frequently than locational decisions: fa-

planning horizon (short and long periods) to model situations where

given planning horizon, a location plan and the associated rout-

We address a multiperiod location routing problem where, for a

infeasibility in a vehicle routing problem with precedence and loading constraints

Gregorio Tirado, Estadística e Investigación Operativa
I, Universidad Complutense de Madrid, Plaza de
Ciencias, 3, 28040, Madrid, Spain,
gregorio.tirado@mat.ucm.es, Angel Felipe, M. Teresa
Ortuño

Transportation industry is forced to face more complex problems every day, making it necessary to introduce new hard constraints such as precedence and loading constraints into the classical vehicle routing problems. In most cases the search performed by heuristics only considers feasible solutions, but for heavily constrained problems like the one considered here this may restrict too much the search process. In our approach we permit the use of infeasible solutions that may violate the capacity or precedence constraints, expanding the search space and making the search process more flexible.

2 - On time dependent 2-path formulations for the (cumulative) TSP

Maria Teresa Godinho, Departamento de Matemática,
Instituto Politécnico de Beja - CIO, Rua Afonso III,1,
7800-050, Beja, Portugal, mtgodinho@estig.ipbeja.pt,
Luis Guervia

It is well known that the so-called 2-path multi commodity formulations for the TSP do not improve the linear programming (lp) bound of the corresponding 1-path formulations. We show that this is not the case when we use time-dependent formulations. In particular, we discuss: i)A new 2-path time dependent model with an lp bound tighter than the corresponding 1-path model ii)Valid inequalities which enhance the lp bound of the new model iii)Computational results showing that the new model enhanced with the valid inequalities produces very tight lp bounds, especially for the cumulative TSP.

3 - Routing costs estimation in a multiperiod location routing problem

Maria Albareda Sambola, Statistics and Operations
Research, Technical University of Catalonia, C.
Colom, 11, 08222, Terrassa, Spain,
maria.albareda@upc.edu, Elena Fernandez, Stefan
Nickel

We address a multiperiod location routing problem where, for a given planning horizon, a location plan and the associated rout-
ing patterns have to be designed. Two scales are considered in the planning horizon (short and long periods) to model situations where routes are modified more frequently than locational decisions: fa-
cilities fixed for a long period remain fixed during several short pe-

routes. To the best of our knowledge, this is the first method that satisfies the legislation on both driving and working hours, and the

first method that includes all optional rules in this legislation.

3 - Evaluation of telematic data with respect to ec-driver regulations for reporting purposes

Thomas Bouzonville, Business and Administration,
Hochschule für Technik und Wirtschaft des Saarlandes,
MA-03
Monday 08:00-09:20
Reger
Sustainable Transport
Stream: Transportation Planning
Invited session
Chair: Melanie Bloos, Chair of Logistics, Bremen University - Department of Business and Economics, Wilhelm Herbst Str.5, 28359, Bremen, Germany, bloos@uni-bremen.de

1 - Evaluating the public procurement of bus transports in terms of emissions and costs
Helene Lidestam, Department of Management and Engineering, Production economics, Linköping University, 58183, Linköping, helene.lidestam@liu.se

The contracts resulting from a public procurement of bus transports in Sweden are very detailed. The specifications of, for example, used bus sizes can lead to unnecessary large buses in the sense that many of them are half empty. Other public procurement processes that could result in more flexible and less specified contracts and in turn reduced CO2-emissions will therefore be tested and evaluated by optimization models. Computational results from a large Swedish bus transport company are reported.

MA-04
Monday 08:00-09:20
Lisz
Scheduling Applications 2
Stream: Scheduling
Invited session
Chair: Hans Heller, CT PP7, SIEMENS AG, Otto-Hahn-Ring 6, 81739, München, Germany, hans.heller@siemens.com

1 - Integrated maintenance planning and order scheduling
Andreas Junker, University of Siegen, Hölderlinstraße 3, 57076, Siegen, Germany, andreas.junker@uni-siegen.de, Peter Letmathe

Most preventive maintenance strategies minimize the costs of break downs and of maintenance tasks without taking interdependencies with traditional scheduling problems into account. This contribution investigates opportunities to simultaneously optimize production and maintenance planning by applying the condition-based maintenance strategy. The condition of each machine is measured through different parameters which determine the machine’s operating performance whereas the machine’s condition deteriorates over time. The presented approach considers a time-discrete and deterministic model.

2 - Production scheduling and inventory management for an ice cream manufacturer using hierarchical planning models
Andrea Cameron, Industrial Engineering, Dalhousie University, 5269 Morris Street, Room 208, B3J 2X4, halifax, NS, axencurls@gmail.com, Eldon Gunn

Two scheduling models were developed for an ice cream facility. A long term, mixed integer programming plan schedules aggregate production to minimize inventory and labour costs while meeting seasonal demand, warehouse, production, and workforce capacities. The short term model schedules production by week to minimize setup and holding costs. Products with shared setups are grouped into families and a 13-week Wagner-Whitin lot size model is created for each family. A mixed integer model finds the least expensive path from weeks 1 to 13 while meeting the aggregated production levels.

MA-05
Monday 08:00-09:20
Haydn
Analysis of DNA and RNA structures
Stream: Computational Biology, Bioinformatics and Medicine
Invited session
Chair: Jacek Blazewicz, Instytut Informatyki, Politechnika Poznanska, ul.Piotrowo 2, 60-965, Poznan, Poland, jblazewicz@cs.put.poznan.pl
Chair: Piotr Formanowicz, Institute of Computing Science, Poznan University of Technology, Piotrowo 2, 60-965, Poznan, Poland, piotr@cs.put.poznan.pl

1 - RNA structure elucidation via nmr: processing of spectral data.
Marta Szachniuk, Institute of Bioorganic Chemistry, PAS, Noskowskiego 12/14, 61-704, Poznan, Poland,
RNA is the foreground actor in the storage and communication of biological data. Major contribution to the knowledge of its structure comes from NMR and X-ray crystallography. But despite the progress in these techniques, recognition and analysis of RNA structure is still very difficult. A lot of difficulty is found in the computational part of structure determination. Here, we analyse the first steps of NMR data processing by automated procedures. We present a short survey through several algorithms for resonance assignment and we introduce a new approach based on neural networks.

2 - Algorithm for non-classical sequencing by hybridization
Marcin Radom, Institute of Computing Science, Poznan University of Technology, 60-965, Poznan, Poland, Marcin.Radom@cs.put.poznan.pl, Piotr Formanowicz

DNA sequencing is a process of reading the sequence of nucleotides in a given DNA. One of the methods for solving this problem is Sequencing by Hybridization (SBH), which can be divided into classical and non-classical. In non-classical approach there can be multiple types of the oligonucleotides in a single microarray probe, all described by a specific pattern. In this work we present a new algorithm for solving sequencing problems basing on non classical SBH spectrum. This algorithm can solve sequencing problems for long DNA strings and it can handle hybridization errors effectively.

3 - Non linear excitation in one dimensional lattices.
Elso Drigo Filho, Department of Physics, Sao Paulo State University, Rua Cristovao Colombo 2265, 15054-000, Sao Jose do Rio Preto, Sao Paulo, Brazil.
elso@philce.unesp.br, Herman Cortez, Jose Roberto Ruggiero

Harmonic one dimensional lattice with an additional Morse potential coupled on site has been used to describe DNA macromolecules properties. In particular, it is conjectured that the non linear excitations (breathers) can be important in the biochemistry process involving this macromolecule. In the present work, we analyse a modification of this lattice introducing a symmetric Morse potential. The existence and stability of the breathers is studied in a modification of this lattice introducing a symmetric Morse potential. DNA sequencing is the process of reading the sequence of nucleotides in a given DNA. One of the methods for solving this problem is Sequencing by Hybridization (SBH), which can be divided into classical and non-classical. In non-classical approach there can be multiple types of the oligonucleotides in a single microarray probe, all described by a specific pattern. In this work we present a new algorithm for solving sequencing problems basing on non classical SBH spectrum. This algorithm can solve sequencing problems for long DNA strings and it can handle hybridization errors effectively.

The planning and optimization of semiconductor manufacturing is a very complex task. So, often a dispatching system is used to control the work centers and to optimize their processes. In this research, different approaches of mixed integer programming will be investigated for optimization of batch processes in selected work centers of a wafer fab. The objective is to keep operational due dates under practical conditions. Also a coupling to different heuristics is discussed. On the basis of real manufacturing data it is then investigated which optimization potential exists for the work center.

3 - Non linear excitation in one dimensional lattices.
Elso Drigo Filho, Department of Physics, Sao Paulo State University, Rua Cristovao Colombo 2265, 15054-000, Sao Jose do Rio Preto, Sao Paulo, Brazil.
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Public Transport Scheduling in Taiwan
Stream: Optimization in Public Transport
Invited session
Chair: Anthony F. Han, Dept. Transportation Technology and Mgt., National Chiao Tung University, 1001 Ta Hseuh Road, 30010, Hsinchu, Taiwan, afhan@pie.com.tw

1 - Commuter bus routing problem: formulation and ta heuristics
Anthony F. Han, Dept. Transportation Technology and Mgt., National Chiao Tung University, 1001 Ta Hseuh Road, 30010, Hsinchu, Taiwan, afhan@pie.com.tw, Cheng Wei Chu

Commuter bus routing problem (CBRP) is a variant of Open Vehicle Routing Problem (OVPR) with a heterogeneous fleet. CBRP is a problem commonly faced by many companies for their employee’s daily commuting. In this paper, we proposed both an IP formulation and Threshold Accepting (TA) heuristics for the CBRP. We applied the TA heuristics to a big semiconductor manufacturer in Taiwan, and found significant improvement in both cost and time savings for the case company.
2 - Mass rapid transit crew scheduling and rostering: constraint programing applications

Anthony F. Han, Dept. Transportation Technology and Mgt., National Chiao Tung University, 1001 Ta Hsueh Road, 30010, Hsinchu, Taiwan, afhan@pie.com.tw, Chun-Te Li

Given a time table, we are concerned with the problem how to find most cost-efficient and legitimate schedules and rosters of train drivers in the operations of a mass rapid transit (MRT) system. We proposed a two-phase approach: first, a CP-MP hybrid method for the scheduling, and second, a CP model for generating the rosters. Both models were applied to a case of Taipei Metro MRT, and yielded good results.

3 - A particle swarm optimization algorithm for the fixed-route bus network design

Wen-Chi Ho, Chung Hua University, 707, Sec.2, WuFu Rd., Hsinchu, Taiwan 300, R.O.C., 300, Hsinchu, Taiwan, D99703020@chu.edu.tw, Jau-Ming Su

In recent years, the government and transit agencies try to provide more efficiency fixed-route bus networks due to the social changes in Taiwan. In fact, the decision is difficult because it involved different stakeholders. This paper proposes a fixed-route bus network model and a particle swarm optimization-based algorithm to assist planners to determine a set of routes and the associated frequencies that achieve the desired objective.
Many manufacturers are dealing with new approaches in order to be more competitive in today’s global markets. Effective supplier performance evaluation system is key factor in raising the competitiveness of firms. In this research, neural network based supplier performance evaluation system is presented. Supervised learning technique and backpropagation algorithm is used training phase of the NN. The network is trained with training datasets. Test examples are used to validate the effectiveness of neural network structure.

2 - Supplier selection problem: a literature review
Andrea Genovese, Dipartimento di Ingegneria Economico-Gestionale, University of Naples “Federico II”, piazzale Tecchio 80, 80125, Naples, Italy, andrea.genovese@unina.it, Giuseppe Bruno, Emilio Esposito, Renato Passaro
Supplier selection problem consists of defining models and methods to measure and rank performances of a set of potential suppliers in a given context. It represents an intrinsically multi-criteria decision making problem, as many conflicting factors should be taken into account. In recent years several approaches have been proposed based on different optimization methodologies. This work provides an extensive literature review for the supplier selection problem, identifying the state of the art and possible directions for further researches.

MA-10
Monday 08:00-09:20
GSI - S 6
Evolutionary Multiobjective Optimization I
Stream: Evolutionary Multi Objective Optimization
Invited session
Chair: Juergen Branke, Warwick Business School, University of Warwick, CV4 7AL, Coventry, United Kingdom, juergen.branke@wbs.ac.uk
1 - Integration of multi-objective computing budget algorithm with evolutionary algorithm
Loo Hay Lee, Industrial and Systems Engineering, National University of Singapore, Singapore, iseleehh@nus.edu.sg, Ek Peng Chew
In this talk, we will discuss how the multi-objective computing budget allocation algorithms (MOCBA) can be integrated into an evolutionary algorithm in handling multi-objective problems when the fitness of the designs need to be evaluated by time-consuming simulations. Numerical experiment shows that MOCBA is able to enhance the ability of the Evolutionary Algorithm in handling stochastic problems.

2 - Effective weighted hypervolume sampling to incorporate user preferences in evolutionary multiobjective optimization
Johannes Bader, Computer Engineering and Networks Lab, ETH Zurich, Gloriastrasse 35, 8092, Zurich, Switzerland, baderj@tk.ee.ethz.ch, Dimo Brockhoff, Anne Auger, Eckart Zitzler
Optimizing the weighted hypervolume indicator is a recently proposed concept to integrate arbitrary user preferences into evolutionary multiobjective optimizers. How to articulate a decision maker’s preference towards reference points and extremes and how to optimize the according weighted hypervolume indicator by means of Monte Carlo sampling has been previously shown but the approach heavily relies on the choice of several parameters of the weight distribution. Here, we propose a new technique that eases the definition of weights such that the search is always affected by the sampling.

3 - Nemo-ii: integrating evolutionary multiobjective optimization and decision making
Juergen Branke, Warwick Business School, University of Warwick, CV4 7AL, Coventry, United Kingdom, juergen.branke@wbs.ac.uk, Salvatore Greco, Roman Slowinski, Piotr Zielniewicz
We propose an improved version of the Necessary-preference-enhanced Evolutionary Multiobjective Optimizer, NEMO-II. It combines evolutionary computation and a multi-criteria decision analysis method, GRIP. The resulting multiobjective optimizer allows the decision maker to interact by comparing pairs of solutions. This information permits to define the set of all compatible value functions. Then, one can compute how far a solution is from the set of solutions being the most preferred for at least one of these functions. This information is then used for ranking in the evolutionary algorithm.

MA-11
Monday 08:00-09:20
GSI - S 17
Evolutionary Multiobjective Optimization V - Applications
Stream: Evolutionary Multi Objective Optimization
Invited session
Chair: Silvio Araujo, Departamento de Ciências da Computação e Estatística-DCCE, Universidade Estadual Paulista-UNESP, R. Cristovao Colombo, 2265 - Jd Nazareth, 15054-000, São José do Rio Preto, São Paulo, Brazil, saraaujo@ibilce.unesp.br
1 - Trade-off optimization in project management: time, budget, and quality
Baruch Keren, Industrial Engineering and Management, Sami Shamoon College of Engineering, Bialik/Basel Sts., 84100, Beer Sheva, Israel, baruchke@scce.ac.il, Yuval Cohen, Yossi Hadad
It is generally accepted that the three major dimensions of project success are time, budget, and quality. Most of the research in project planning is focused on the time-cost trade-off and only a few papers appearing in the literature have considered the three dimensions together. The first part of this paper describes the evolution of linear programming formulations for optimizing project time-cost trade-off. The paper continues by developing as a natural extension a non-linear optimization formulation, taking into account a multiple trade-off structure between time, budget, and quality.

2 - Optimizing additive fabrication processes using evolutionary multiobjective optimization techniques
Vassilis Dedoussis, Industrial Management & Technology, University of Piraeus, 80 Karaoli & Dimitriou str., 185 34, Piraeus, Greece, vdedo@unipi.gr, Vassilis Canelidis, John Giannatsis
In this work evolutionary multiobjective techniques are utilized in a decision support system which provides Stereolithography end users with near optimal build orientation and packing arrangements. To cope with the multi-criteria nature of the problem, the proposed framework examines the feasibility of employing a Genetic Algorithm as a search technique in conjunction with a weighted multi-objective function as a means for the evaluation of the ‘score’ of possible solutions. Various aspects of the Genetic Algorithm are examined in order to test the robustness and effectiveness of the approach.
3 - A stochastic approach to the decision support procedure for a generation company operating on day-ahead and physical derivatives electricity markets

Cristina Corchero, Estadistica i Investigacio Operativa, Universitat Politècnica de Catalunya, c/Jordi Girona 1-3, Campus nord, Ed. C5, dspt 224, 08034, Barcelona, cristina.corchero@upc.edu, Maria Teresa Vespucci, F. Javier Heredia, Mario Innorta

A decision support procedure was developed for the short-term hydro-thermal resource scheduling problem of a price-taker GenCo operating both the Day-Ahead and Derivatives Electric Market. The derivatives products considered are the physical futures contracts which entail a quantity of energy that has to be produced mandatorily. A stochastic programming model is introduced for the unit commitment and the economic dispatch problem with both technical and market constraints. The spot-price uncertainties are considered and introduced in the model through a set of scenarios.

3 - Heuristic method to the one-dimensional cutting stock problem

Silvio Araujo, Departamento de Ciências da Computação e Estatística-DCCE, Universidade Estadual Paulista-UNESP, R. Cristovao Colombo, 2265 - Jd Nazareth, 15054-000, São José do Rio Preto, São Paulo, Brazil, saraujo@ibilce.unesp.br, Andre Lopes

This study deals with the one-dimensional integer cutting stock problem, which consists of cutting a set of available objects in stock in order to produce ordered smaller items in such a way as to optimize a given objective function. We studied the case in which there is only one type of object in stock available in unlimited quantity. A multi-objective evolutionary algorithm is proposed to solve the problem considering two conflicting objective functions, the minimization of the number of objects to be cut and the minimization of the number of different cutting patterns.

3 - Portfolio optimization in the natural gas value chain

Erkan Kalayci, Institute of Applied Mathematics, Istanbul Teknik Universitesi Endustri Muh. Bolumu, Besiktas, 34349, Istanbul, Turkey, erk_kal@hotmail.com, Semih Onur

Waste management is an important and rapidly growing industry for developing countries, such as Turkey. Increasing industrial development and rapid urbanization cause an increasing gap between demand and supply of products. In this study, a two-stage stochastic model is presented to determine a long-term strategy under uncertainty for a large-scale real-world recycling network design problem which includes optimal locations and optimal flow amounts between the nodes in the multi-facility environment.

3 - Stochastic portfolio optimization in the nigerian electricity sector

Erdem Gundogdu, Industrial Engineering, Istanbul Kultur University, IKU Atakoy Campus Room:210 Bakirkoy, 34156, Istanbul, gundogduerdem@gmail.com, Ilkay Gultas

Selin Soner Kara, Yildiz Technical University, Yildiz Teknik Universitesi Endustri Muh. Bolumu, Besiktas, 34349, Istanbul, Turkey, ssoner@yildiz.edu.tr, Semih Onur

The price of slots purchased by clients differs with several factors. There are also regulations that the TV companies must obey. Also clients ask not to locate theirs with their competing products in the same break. Therefore, the commercials must be scheduled in a manner that each client is satisfied. Traditionally, these schedules are done manually so that it requires a tedious work and is an error-prone process. Thus, we try to reformulate the scheduling problem with a stochastic programming approach. We aim to satisfy the clients while reducing the errors and increasing the profits.

2 - Reverse logistics network design with unknown parameters

F. Javier Heredia,帝國理工學院, Brunel University, M113 John Crank Building, Brunel University, UB8 3PH, London, United Kingdom, tong.ji@brunel.ac.uk

We present a short-term portfolio optimization model for a large natural gas producer. The model includes spot market sales, production plans, storage management and fulfillment of long-term contracts. The paper discusses the value of actively using the storage capacity provided by the line-pack of the pipelines to maximize profit for the producer. We also study the value of using a stochastic model as compared to a deterministic model. The model is tested over two 60-days periods using real market data and realistic production and transportation capacities.

2 - A three-stage stochastic short-term scheduling model for hydro power and wind power coordination

Maria Teresa Vespucci, Dept. of Management Engineering, University of Bergamo, via Marconi, 5a, 24044, Dalmine (BG), Italy, mtespus@tin.it, Francesca Maggioni, Marida Bertocchi, Mario Innorta

In this paper we develop a stochastic programming model for the short-term optimal scheduling in an electricity production system consisting of hydropower, pumped storage and wind-power plants. The uncertainty on wind power production is taken into account by using a three-stage stochastic program, as information evolves over time. The problem can be used for storing potential energy.

2 - Portfolio optimization in the natural gas value chain

Kjetil Midtun, Applied Economics, SINTEF, S.P Andersens vei 5, 7465, Trondheim, Norway, Kjetil.Midtun@sintef.no, Asgeir Tomassgard, Matthias P. Nowak

We present a short-term portfolio optimization model for a large natural gas producer. The model includes spot market sales, production plans, storage management and fulfillment of long-term contracts. The paper discusses the value of actively using the storage capacity provided by the line-pack of the pipelines to maximize profit for the producer. We also study the value of using a stochastic model as compared to a deterministic model. The model is tested over two 60-days periods using real market data and realistic production and transportation capacities.
Since years Nigeria has a problem of shortage of electricity and has the highest uncertainty of electricity supply in the world. Among the main reasons are lack of enough power plant capacity, inefficient transmission and distribution networks, obsolete equipments and low electricity tariff. The aim of this study is to model and to solve a stochastic portfolio optimization for the whole Nigerian electricity sector to maximize overall profit, given that at every time supply and demand are in balance, through generating possible scenarios for gas prices, exchange rates and energy demand.

4 - Optimal trading strategy using financial derivatives

Tong Ji, CARISMA, Brunel University, M113 John Crabck Building, Brunel University, UB8 3PH, London, United Kingdom, tong.ji@brunel.ac.uk, Gautam Mitra

Stock market is not perfectly frictionless in short run; transactions of an institutional investor can be exercised substantially different from the decision price. It is now customary to divide a large trade into several consecutive transactions. The investors now have to trade off between the adverse effect of their own trading activities and uncertain future price movement. We proposed that investor can reduce their implementation shortfall due to price uncertainty by trading on both spot and derivative markets. An optimal trading strategy is derived using stochastic programming model.

3 - Hardening facilities against random disruptions

Maria Paola Scaparra, Kent Business School, University of Kent, The University, CT2 7PE, Canterbury, United Kingdom, M.P.Scaparra@kent.ac.uk

We consider a median system with p facilities which are vulnerable to random disruptions. We present a stochastic protection model which identifies the optimal allocation of protection resources among the facilities so as to minimize the expected operational costs to serve the customers. We show how to obtain a network-flow-type linear model for this problem. The resulting model can be directly solved by commercial MIP solvers. We also propose a GRASP algorithm to solve large problem instances and report results for several benchmark problems.

3 - A joint location inventory warehouse model

Francisco Silva, Economics and Business, University of the Azores, Rua da Mae Deus, Ponta Delgada, 9500, Ponta Delgada, Portugal, fsvila@ua.pt, Daniel Serra

In this paper we present a mixed integer discrete warehouse joint location inventory problem. Demand in each node is considered to follow a normal distribution. The objective function has two main components: transportation costs and inventory costs that are dependent on the demand in each node. We model the problem as a mixed-integer program and develop a heuristic that is derived using stochastic programming model.
3 - A generalised vehicle routing problem with mixed deliveries and pickups
Gabor Nagy, Kent Business School, University of Kent, CT2 7PE, Canterbury, United Kingdom, G.Nagy@kent.ac.uk, Said Salhi, Niaz Wassan
The VRP with deliveries and pickups is an important problem within reverse logistics. We aim to introduce flexibility in allowing pickups to be loaded onto the vehicle, but subject to a restriction on the mixture of delivery and pickup goods onboard. A mathematical formulation is provided and optimal results or bounds are found for small instances. We develop a heuristic solution algorithm, based on the powerful meta-heuristic reactive tabu search. The obtained results demonstrate the usefulness of this practical logistic problem while providing results for benchmarking purposes.

4 - Multiperiodic vrp models and GRASP algorithms for goods distribution with reverse flows
Pierre Dejax, Industrial Engineering - IRCCyN, Ecole des Mines de Nantes, BP 20722, 44307, Nantes Cedex 3, pierre.dejax@emn.fr
We consider generic problems for the multiperiodic distribution planning and routing in a network with a central warehouse and retail stores, including return flows of pallets or products. Time windows, split delivery or storage at the retail stores are considered. We have developed a heuristic solution technique based on different classical and hybrid variations of the the GRASP metaheuristic and a column generation approach. We present results based on experimentations on set of 1848 instances of various characteristics generated from the Solomon’s testbed for the VRPTW with 25 sites.

MA-16

Multiple Criteria Integer and Linear Programming

Stream: Multi-Objective Optimization and Decision Theory 1

Chair: Dogan Ozgen, Industrial Engineering Department, Yildiz Technical University, Yildiz, Barbaros Boulevard, 34349, ISTANBUL, Besiktas, doganozgen@gmail.com

1 - Optimizing a linear function over the epsilon-efficient set of a multiobjective mixed integer linear programming problem.
Alejandro Crema, Escuela de Computación, Facultad de Ciencias, Universidad Central de Venezuela, Apartado 47002, 1041-A, Caracas, Venezuela, alejandro.crema@ciens.ucv.ve
Norma Guzmán
Optimizing a linear function over the epsilon-efficient set of a multiobjective Mixed Integer Linear Programming (MILP) problem is a topic of unquestionable practical as well as mathematical interest. In this work we present an algorithm to solve the problem given a tolerance for the difference between the supreme and the obtained value. The approach proposed defines a sequence of progressively more constrained single objective MILP problem that successively eliminates undesirable points from further consideration.

2 - Multiobjective possibilistic linear programming approach for multiechelon supply chain design
Dogan Ozgen, Industrial Engineering Department, Yildiz Technical University, Yildiz, Barbaros Boulevard, 34349, ISTANBUL, Besiktas, doganozgen@gmail.com, Bahadir Gulsun
Designing multiechelon supply chain is a complex and imprecise multiobjective decision making problem. In this paper, we first define a multiobjective possibilistic linear programming considering various conflicting objectives simultaneously: i) min cost, ii) min transportation time. After we apply the steps of possibilistic linear programming approach to be able to proposing alternative results for decision makers. An illustrative example is given. Computational results indicate that this approach can give better than crisp LP approaches because some critical parameters can be defined imprecisely.

MA-17

Scheduling with batching and lot-sizing

Stream: Scheduling under Resource Constraints

Chair: Mikhail Kovalyov, Faculty of Economics, Belarusian State University, Nezavisimosti 4, 220030, Minsk, Belarus, kovalyov_my@yahoo.co.uk, Sergey Kovalev, Erwin Pesch

We consider the imperfect production of several products on the same facility. Operations on product items are performed in batches. Defectiveness of an item is determined by a given function of its product, its preceding product, and the position of its operation in the batch. Defective items are kept in a buffer and then are remanufactured on the same facility. The objective is to minimize maximum lateness with respect to product due dates. NP-hardness is proved, and a heuristic group technology solution approach is suggested. The results apply for scheduling car paint shops.

2 - A new problem of lot-sizing and sequencing under uncertainties
Alexandre Dolgui, IE & Computer Science, Ecole des Mines de Saint Etienne, 158, cours Fauriel, 42023, Saint Etienne, France, dolgui@emse.fr, Frédéric Grimaud, Genrikh Levin, Kseniya Shchamalhova
A problem of lot-sizing and sequencing of manufacturing items for a production line with random machine breakdowns and random rejections is considered. Set-up times are taken into account. The goal is to maximize the probability of a desired output for a given period. The approach is based on the decomposition of the initial problem in two sub-problems: a travelling salesman problem and a knapsack problem. An iterative optimization procedure is proposed. Some tests are given and comparisons with heuristics and simulation are reported.

3 - A new batch scheduling problem in machining environment
Alexandre Dolgui, IE & Computer Science, Ecole des Mines de Saint Etienne, 158, cours Fauriel, 42023, Saint Etienne, France, dolgui@emse.fr, Olga Guschinskaya, Nikolai Guschinsky, Genrikh Levin
This presentation concerns a new scheduling problem for machining lines. This problem can be formulated as scheduling for a single max-batch machine with inclusion, exclusion and precedence constraints between jobs and under the condition that the time of a batch can exceed the time of its longest job. This problem is solved using the constrained shortest path approach. Dominance properties were developed to decrease the digraph's size. An illustrative example is reported.

4 - Structural properties for job shop scheduling under batch availability

Liji Shen, TU Dresden, Striesener Str. 14, 01307, Dresden, Germany, liji@liji.de, Udo Buscher

As a prominent variant of batch scheduling problems, batch availability stipulates that all jobs assigned to the same batch are released simultaneously. Practical applications arise when, for instance, products are placed on pallets for manufacturing. Scheduling with transport issues also resembles this specific requirement. In our study, we focus on investigating the job shop problem subject to batch availability. Structural properties are first presented, based on which, we propose two algorithms, which ensure solution feasibility and enable an efficient determination of objective values.

MA-18
Monday 08:00-09:20

Mathematical Programming in Networks 2

Stream: Mathematical Programming

Invited session

Chair: Gerhard-Wilhelm Weber, Institute of Applied Mathematics, Middle East Technical University, ODTÜ, 06531, Ankara, Turkey, gweber@metu.edu.tr

Chair: Armin Fügenschuh, Optimierung, Zuse Institut Berlin, Takustraße 7, 14195, Berlin, Germany, armin.fuegenschuh@googlemail.com

1 - Global optimization and complementarity for solving a traffic problem

Isabel Ribeiro, Engenharia Civil (SMF), Faculdade de Engenharia da Universidade do Porto, Rua Dr. Roberto Frias, s/n, 4200-465, Porto, Portugal, iribeiro@fe.up.pt, Maria Lurdes Simões

In this talk, we discussed an optimal cycle length for a signalized intersection regulated by pretimed control problem, which is formulated as a Mathematical Programming Problem with Complementarity Constraints (MPCC). The model describes the evolution of the queue lengths (number of waiting vehicles) of each lane as a function of the time and the green split allocation at isolated intersections. A parametric enumerative method is proposed for solving the MPCC. Computational experience with real problems is included to highlight the efficacy of the procedure in practice.

2 - Material flow networks as modeling language for material flow based optimization problems

Hendrik Lambrecht, IAF, Hochschule Pforzheim, Tiefenbronner Str. 65, 75175, Pforzheim, Germany, hendrik.lambrecht@hs-pforzheim.de, Mario Schmidt, Andreas Möller

An important issue in designing DSS is the user-software interface. As is known, visualization strongly enhances comprehension which is crucial for obtaining meaningful results. It also facilitates communication among the people working on the solution to a specific problem. We propose the use of graph-based material flow networks (MFN) as an alternative to algebraic modeling languages for the optimization of material flow systems. Results from the BMBF-funded research project KOMSA are presented: a concept that combines MFN with direct search optimization as well as a software prototype.
In the present talk, based on the classical concept of convex functions as well as on its generalization by E. M. Wright and motivated by T. Popoviciu's convexity notions, higher-order convexity properties of real functions are investigated. In particular, we characterize higher-order Jensen-convex and Wright-convex functions via generalized derivatives, we prove the localizability of such type convexities, and we present some results on the comparison of different forms of higher-order convexity.

4 - Profit efficiency of bank branches: the impact of the environment

Michel Dietsch, IEP, Université de Strasbourg, 47, avenue de la Forêt Noire, 67000, Strasbourg, michel.dietsch@urs.u-strasbg.fr

This paper attempts to estimate efficiency of a sample of 1,618 branches of a large French bank, while taking account the impact of the environment. Using the directional distance function and the linear programming methodology, it estimates gross technical inefficiency levels ignoring the environmental effect. Then, it re-estimates the frontiers by environment to get adjusted measures of net technical inefficiency and environmental inefficiency. At the branch level, the average inefficiency contribution of environment to total inefficiency is greater than 40%.

MA-21

Quantitative Health Care Policy Decision Making

Stream: Health Care Management

Chair: Marion Rauner, Dept. Innovation and Technology Management, University of Vienna, Briennerstr. 72, A-1210, Vienna, Austria, marion.rauner@univie.ac.at

1 - The role of health care management games for teaching and policy decision making

Marion Rauner, Dept. Innovation and Technology Management, University of Vienna, Briennerstr. 72, A-1210, Vienna, Austria, marion.rauner@univie.ac.at, Sigrun Schwarz, Markus Kraus, Jörg Gesslbauer, Panosch Barbara

Operations Research, internet, and e-learning highly increased the potential of this tool for teaching and policy making in the last years. First, we give a short overview on general management games. We then especially focus on the importance of Operations Research techniques for health care games.

2 - A dynamic model of drug supply and demand

Gernot Tragler, OR and Nonlinear Dynamical Systems, Vienna University of Technology, Argentinierstr. 8/105-4, A-1040, Vienna, Austria, tragler@cos.tuwien.ac.at, Jonathan Caulkins

Illicit drug consumption imposes enormous health care costs to societies all around the globe. For many years OR has already set a focus on the management of drug epidemics, but so far, the supply and demand of drugs has hardly been analysed in a joint study. Here we present a dynamic model of both the supply and the demand of drugs with the main objective of minimizing the social costs that arise from drug use. In mathematical terms, we present a system of ODEs with three state variables representing the number of susceptible, the number of users, and the throughput capacity of supply.

3 - An integrated simulation and optimization approach to support surgical department management

Angela Testi, DIEM-Dip.Economia e Metodi quantitativi, Universita’ di Genova, via Vivaldi 5 -16126 GENOVA-ITALIA, FACOLTA’ DI ECONOMIA, 16126, GENOVA, testi@economia.unige.it, Elena Tanfani
We study an integrated use of optimization and simulation for the management and capacity planning of a surgical department. In particular a discrete event simulation model is developed to take care of the stochastic nature of the system under study. Moreover, an optimization model for the so-called Master Surgical Schedule Problem (MSSP) generates optimal allocation plans for the operating rooms that can be used as input data for the simulation model. The simulation experiments give insight towards performance improvement based on different operative rules for operating rooms and stay area.

4 - Simulation modelling for bipolar disorder — the pam project
Sally Brailsford, University of Southampton, School of Management, SO17 1BJ, Southampton, United Kingdom, s.c.brailsford@soton.ac.uk, S Mohiuddin

Personalised Ambient Monitoring is a multidisciplinary project using a set of sensors placed in the home, or worn on the body, to monitor BD patients’ daily activity patterns or ‘signatures’. PAM aims to provide early feedback to patients when their behaviour starts to deviate from normal, so they can seek medical help and avoid a serious episode. We use MC simulation to determine value and effectiveness of PAM in the face of uncertainty about the acceptability and reliability of the sensors, and the accuracy of the algorithms used to determine deviation from normal activity.

3 - GAMS — features you might not know about
Alex Meeraus, GAMS Development Corporation, Washington, DC, United States, alex@gams.com, Michael Bussieck, Jan-Hendrik Jagla, Franz Nelissen, Lutz Westermann

In the last decade the General Algebraic Modeling System (GAMS) has been improved in various ways. Some of the improvements are visible and known to most of the users like the availability of new solvers or changes you can see in the integrated development environment. Others are more hidden and the user might not know that these exist like the Macro Facility and the Matching Operator.

In this talk we give an overview of features which were added in the recent and not so recent past. We will focus on things which were not talked about in scientific presentations before.

1 - AHP and topsis to evaluate the emerging industry credit ability for banking sector

Yi-Shan Chen, Graduate School of Management, Ming Chuan University, 250 Chung Shan N. Rd. Sec. 5., 11103, Taipei, Taiwan, ys13.chen@msa.hinet.net, Chin-Tsai Lin, Jung-Ho Lu

This paper proposes an evaluation of emerging industry credit model. The paper presents an evaluation framework through modified Delphi Method. Next, a case demonstrate proposed model, followed the relative weights of evaluative criteria and sub-criteria are determined using the analytic hierarchic process (AHP) model, the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) approach to rank the alternatives. Importantly, the proposed model can assist the banking sector to assess the emerging industry credit ability.

2 - A locational decision making of a logistics center for turkish clothing industry

Selin Hanife Eryuruk, Textile Engineering Department, Istanbul Technical University, Inonu Cad. No.87 Gumussuyu, Beyoglu, 34437, Istanbul, Turkey, hanifealiskan@yahoo.com

The clothing industry is one of the most competitive and high value-added sector in the world however in recent years clothing industry has suffered difficult times. Logisticians is a very important strategy to get competitive advantages like time, cost and customer satisfaction. This paper presents a locational decision making of a logistics center for Turkish Clothing Industry in Marmara Region in Turkey. A numerical study with a questionnaire survey database aimed at the clothing industry of Turkey was conducted and Analytic Hierarchical Process (AHP) was used to evaluate the questionnaire results.

3 - A new approach of the AHP method: application for trend determination

Szabolcs Duleba, Economics and Logistics, College of Nyiregyháza, Hungary, 4400 Nyiregyháza, Ferenc krt.2., 4400, Nyiregyháza, duleba@nyf.hu
usually the extrapolation of relevant data from the past has been used by the scientific literature to determine different trends. This practice can be less effective in the case of fast changing markets. Moreover, in the recently ongoing world economic crisis, many of the traditional economic forecasting models are proved to be wrong. Expectable changes can much better be forecasted, if the extrapolation is supplemented by a synthesis of opinions from experts and key-players of the sector considering the future. In the paper, a model is set up to elaborate logistics trends by the AHP method.

4 - An integrated approach for global supplier selection decision

Aycan Aytekin, International Trade, Bogazici University, Hisar Campus Bebek, 34342, Istanbul, Turkey, ycnaytekin@yahoo.com, Arzu Tektas

Global supplier selection is a significant issue in the competitive international trade environment. The issue is analyzed integrating Analytic Hierarchy Process and Linear Programming (LP). The hierarchy includes criteria like supplier’s country risk, competitiveness, international trade characteristics, logistics cost, quality, safety and environmental concern. LP selects the best suppliers to maximize the buyer’s total purchasing value. The approach is implemented on a multinational chemical company in Turkey. The results may form a basis for similar studies and applications.

**MA-24**

Monday 08:00-09:20

**GSI - S 20**

**Semi-infinite Optimization**

Stream: Semi-Infinite Optimization

**Invited session**

Chair: Jan-J Ruckmann, School of Mathematics, University of Birmingham, Edgbaston, B152TT, Birmingham, United Kingdom, J.Ruckmann@bham.ac.uk

1 - A genetic algorithm framework for multilocal optimization

A. Isaacd F. Vaz, Dept. Production and Systems, University of Minho, School of Engineering, Campus de Gualtar, 4710-047, Braga, Portugal, aivaz@dps.uminho.pt, Lino Costa

Multilocal optimization is devoted to determine multiple local optima for an optimization problem. A special interest in the computation of global optima is addressed. We propose an hybrid algorithm that couples a genetic algorithm with a local search quasi-Newton method. A biobjective approach is used to optimize the objective function simultaneously with the gradient norm of the Lagrangian function. An useful application of such an algorithm is in the context of reduction type methods for semi-infinite programming. Some numerical results will be shown with a set of test problems.

2 - Explicit solution of the lower level problems for the cooling layout optimization in injection molding

Volker Maag, Optimization, Fraunhofer-Institut für Techno- und Wirtschaftsmathematik, Fraunhofer-Platz 1, 67655, Kaiserslautern, Germany, maag@itwm.fhg.de, Karl-Heinz Küfer

Injection molding is an important mass production procedure. Since the cooling of the mold has an essential influence to the production costs and the product quality, the design of the cooling system must be optimal. The geometric constraints of the problem are complex and of semi-infinite type. Yet, it is possible to model them in such a way that the solution of the lower level problems can be explicitly expressed as a continuously differentiable function. This observation is based on a known generalization of the implicit function theorem and eases solving the problem significantly.

3 - Solving sip by penalty techniques: merit functions and filter method

Ana I. Pereira, Polytechnic Institute of Braganca, Campus de Sta Apolonia, Apartado 134, 5301-857, Braganca, Portugal, apereira@ipb.pt, Edite M.G.P. Fernandes

We present a brief review of reduction type methods to solve non-linear semi-infinite programming (SIP) problems. During the last decades a variety of techniques that apply the local reduction theory have been proposed in the literature. Besides the well-known sequential quadratic programming to solve the reduced finite problem, some penalty based techniques have been used with success. In general, they rely on continuous merit functions for SIP. However, the so-called filter method, an alternative to merit functions, has already been tested. Comparisons with both strategies are presented.

**MA-25**

Monday 08:00-09:20

**GSI - S 25**

Assignment Games

Stream: Cooperative Game Theory

**Invited session**

Chair: Tamás Solymosi, Operations Research, Corvinus University of Budapest, Fovam ter 8, 1093, Budapest, Hungary, tamas.solymosi@uni-corvinus.hu

1 - A glove market partitioned matrix related to the assignment game

Marina Nunez, Economic and Financial Mathematics, University of Barcelona, Av Diagonal, 690, 08034, Barcelona, Spain, mnunez@ub.edu, Carles Rafels

To any assignment market we associate the unique exact assignment game defined on the same set of agents and with a core that is a translation of the core of the initial market. Also he kernel and the nucleolus of an assignment game are proved to be the translation of the kernel and the nucleolus of its related exact assignment game by the vector of minimum core payoffs. Agents on each side of the market are classified by means of an equivalence relation and the equivalent classes partition the matrix of the related exact assignment game into glove markets.

2 - Axiomatizations of the Shapley value on the class of assignment games

Miklos Pinter, Mathematics, Corvinus University of Budapest, Fovam ter 13-15., 1093, Budapest, miklos.pinter@uni-corvinus.hu

We consider various axiomatizations of the Shapley value on the class of assignment games. We conclude that the class of assignment games is a very pathological class from the uniqueness point of view, since except to van den Brink’s special characterization, all axiomatizations we consider fail to characterize the Shapley value. As byproducts, we give some examples on the relations between some of the axioms.

3 - Longest paths to the core in assignment games

Tamás Solymosi, Operations Research, Corvinus University of Budapest, Fovam ter 8, 1093, Budapest, Hungary, tamas.solymosi@uni-corvinus.hu
We consider the problem of computing the buyer-/seller-optimal vertices of the core of an assignment game. Although the proof of Shapley and Shubik (1972) for the existence of these vertices can be easily turned to a computational method, we propose a network approach. We define a directed graph and show that the lengths of the longest paths to its nodes give exactly the minimum core payoffs to the associated players. We also demonstrate how this characterization can be used in analyzing the sensitivity of the optimal core-allocations to changes in the underlying data matrix.

4 - Symmetrically multilateral-bargained allocations in multi-sided assignment markets
Oriol Tejada, passeig Joan de borbo 70 3o 3a, 08003, Barcelona, Catalunya, oriol.tejada@ub.edu, Carles Rafels
We extend Rochford’s (1983) notion of symmetrically pairwise-bargained equilibrium to assignment games with more than 2 sides. A symmetrically multilateral-bargained (SMB) allocation is a core allocation so that any agent is in equilibrium with respect to a negotiation process among all agents based on what every agent could receive in her preferred alternative matching to the optimal matching that is formed. We prove that, for balanced multi-sided assignment games, the set of SMB is always nonempty and that, unlike the two-sided case, it does not coincide in general with the kernel.

3 - A clonal selection algorithm for the quadratic multiple knapsack problem
Tugba Sarac, Department of Industrial Engineering, Eskisehir Osmangazi University, Meselik Kampusu, 26480, Eskisehir, Turkey, tsarac@ogu.edu.tr, Berna Ulutas
Knapsack Problem (KP) is one of the well known combinatorial optimization problems. In this study, we considered a KP called as quadratic multiple knapsack problem (QMKP) with k knapsacks and quadratic objective function. We proposed a clonal selection algorithm for QMKP. The performance of the developed algorithm is evaluated and the obtained results are compared with the previous studies in the literature.

MA-26
Monday 08:00-09:20
GSI - S 35
Knapsack Problems
Stream: Discrete Optimization
Contributed session
Chair: Tugba Saraç, Department of Industrial Engineering, Eskisehir Osmangazi University, Meselik Kampusu, 26480, Eskisehir, Turkey, tsarac@ogu.edu.tr
1 - Meta/exact hybridization to improve intensification in combinatorial optimization problems
Samir Mahdi, Compute scince, University Mentouri, Constantine. labo MISC, 93 bld pastuer belle vue, 25000, Constantine, Algeria, s.mahdi_dz@yahoo.fr, Salim Chikhi, Mohamed Batouche
In this paper we propose to hybridize the metaheuristic MA/PM and B&B to solve combinatorial optimization problems. Our idea is to add in the metaheuristic, an exact method, which has an absolute research power, in order to improve the intensification around the best current solution found by the metaheuristic, during the research. We have realized experiments on well-known benchmarks in the literature of the knapsack problem. The results obtained show the effectiveness of Meta/Exact hybridization.

2 - A cooperative local search-based algorithm for the multiple-scenario max-min knapsack problem
Abdelkader Shibi, Dept. of Information Systems and Aided Decision, Audencia-Nantes School of Management, 8 route de la Jonelière, BP 31222, 44312 , Nantes Cedex 3, France, ashibi@audencia.com
The Multiple-Scenario Max-Min Knapsack Problem (MSM2KP) is a variant of the Knapsack Problem. It models situations such that we face many scenarios and the aim is to identify the best one offering a better alternative. Each scenario considers a different item profit with one weight. The aim is to maximize the profit for the worst scenario. Our cooperative method uses a limited-area local search applied in the elite neighborhood and a wide range one applied to perform an improving sequence of path exchange. The results are promising and we show the method efficiency.

1 - Multiple berth allocation problem
Hossein Jula, Electrical Engineering, Penn State Harrisburg, W-256 Olmsted Bldg., 777 Harrisburg Pike, 17057, Middletown, PA, hjula@psu.edu, Hwan Chang, Anastasios Chassiakos, Petros Ioannou
When, under some predicted or unpredicted scenarios, a calling vessel cannot moor at its home berth location, other berth locations (within the same terminal or adjacent terminals) may accommodate the vessel. This leads to a more complex variant of the Berth Allocation Problem (BAP) which, in this paper, is referred to as the multiple Berth Allocation Problem (mBAP). This paper presents a heuristic solution methodology for the mBAP. Several experimental scenarios are generated to evaluate the proposed solution methodology for the mBAP.

2 - The impact of foldable containers on empty container management
Koichi Shintani, Department of Shipping Technology, Oshima National College of Maritime Technology, 1091-1 Komatsu, Suo-osshima, 7422193, Oshima, Yamaguchi, Japan, shintani@oshima-k.ac.jp, Rob Konings, Akio Imai
This paper analyzes the possibility of foldable container usage in order to save container repositioning costs. Integer programming models are employed to find the optimal empty container repositioning in order to calculate the costs. The study finds that the foldable containers substantially save the repositioning costs, compared to standard containers. It is also shown that comparative advantages of the foldable containers depend on container traffic situations such as empty transfer distance, degree of trade imbalance, etc.
2 - Empirical analysis of online algorithms for multiple trading problems

Günther Schmidt, Saarland University, Box 151150, 66041, Saarbrücken, Germany, gs@itm.uni-sb.de, Esther Mohr

We suggest different active trading algorithms which try to solve this type of problem. Their effectiveness is analyzed from a worst case and an average case point of view. We compare average case and worst case bounds using simulation on historical data for the past ten years. We give an answer to the questions how parameters effect the quality of the algorithms and if they show a superior behaviour to buy-and-hold policies.

3 - Corporate structure optimisation for multinational companies

J. E. Beasley, CARISMA, Brunel University, Department of Mathematical Sciences, Kingston Lane, UB8 3PH, Uxbridge, Middlesex, United Kingdom, john.beasley@brunel.ac.uk

We consider a multinational tax planning problem that involves designing a corporate structure (across different countries) so as to remit profits from a number of subsidiaries to a single parent company, whilst minimising the tax paid (maximise the amount received at the parent company). This corporate structure is constrained to be a (directed) tree structure. We present a nonlinear mixed-integer zero-one formulation that is linearisable as well as a tabu search algorithm. Computational results are given for both the optimal and heuristic solution of publicly available test problems.

1 - Bilevel optimization analysis of electricity generation capacity expansion

Efraim Centeno Hernández, Instituto de Investigación Tecnológica, Universidad Pontificia Comillas, Santa Cruz de Marcenado 26, 28015, Madrid, Spain, efraim.centeno@upcomillas.es

A bilevel optimization model to analyze the decision of building new power plants from the point of view of a generation company based on its profitability is proposed. Upper level includes profit as objective function and lower level represents electricity spot market behaviour using a conjectured variation schema. This schema is an extension of Nash-Cournot market equilibrium and allows representing different degrees of competition in the market.

2 - Generation capacity expansion under long-term uncertainties in the us electric market

Sabine Goutier, OSIRIS, EDF R&D, 1 AVENUE DU GENERAL DE GAULLE, 92140, CLAMART, sabine.goutier@edf.fr, Julian Bouchard, Alexandre Klein

In this paper, we deal with generation capacity expansion under long-term uncertainties regarding fuel prices and CO2 emissions regulation. We present a model based on stochastic dynamic programming which gives optimal generation investment planning for perfectly competitive power markets. Using DOE’s fuel price scenarios, we show that taking into account uncertainties on fuel costs and on CO2 emissions regulation can change the optimal investment decisions. Moreover, we show that, for generators, the level of risk-aversion is a major factor influencing the investment decisions.

3 - Assessing energy storage value for power systems with a large penetration rate of intermittent renewables

Julien Martin, R&D OSIRIS, EDF, 1 ,av. du général De Gaulle, 92141, Clamart, julien2.martin@edf.fr

This paper focuses on modeling issues to study the interest of utility companies for energy storage capacities/capabilities on a prospective “low-carbon electricity” scenario. Within the 2030-2050 timeframe, the massive integration of intermittent renewables may affect system reliability by increasing difficulties to balance supply and demand while respecting physical constraints. A major objective/stake is to quantify which difficulties could appear and which technological solutions should be targeted and combined to supply extra-flexibility required to deal with renewables intermittency.

4 - Tools for long term strategic spanish electricity sector analysis.

Jose Villar, Instituto de Investigacion Tecnologica, Universidad Pontificia Comillas, Alberto Aguilera 23,
MORSE is a set of tools developed for Endesa, for long term analysis of the Spanish electricity sector. It models its main business, such as electricity pool, commercialization, regulated activities, etc, and computes the yearly accumulated deficit of the sector. Pool is solved with a supply function market equilibrium computed by EQUI-TEC, where GENCO’s are represented by technologies. EQUI-TEC computes agent conjectures assuming linearity and robustness near equilibrium, and has a Monte Carlo version for statistical outputs. MORSE includes a genetic solver to attain predefined targets.

**MA-30**
**Dynamic Programming II**
Stream: Dynamic Programming
*Invited session*

Chair: Lidija Zadnik Stirn, Biotechnical Faculty, University of Ljubljana, Vecna pot 83, 1000, Ljubljana, Slovenia, lidija.zadnik@bf.uni-lj.si

1 - Structuring new product development (npd) pipelines considering resource constraints
Yu Xiong, University of York, The York Management School, Sally Baldwin Buildings, Heslington, YO10 5DD, York, North Yorkshire, yx515@york.ac.uk, Kiran Fernandes

This paper investigates two issues within the New Product Development process, viz.: How to allocate resources to multiple pipelines and then to multiple stages of a single pipeline with a constrained budget. Existing literature has focused on increasing the likelihood of having at least one successful product in a pipeline but has not considered the balance of achieving maximum probability of success with a given budget constraint. We present a normative model (dynamic programming) for structuring pipelines for resource constrained situation.

2 - Multiple criteria decision analysis within a dynamic environmental system
Lidija Zadnik Stirn, Biotechnical Faculty, University of Ljubljana, Vecna pot 83, 1000, Ljubljana, Slovenia, lidija.zadnik@bf.uni-lj.si

To solve a multicriteria and long term management problem of an environmental system, a discrete dynamic and multicriteria decision support model (DSM) is generated. SWOT analysis and AHP/ANP (eigenvalue and DEA procedure) are employed to evaluate conflicting objective functions. Then, states, decisions, weighted values of objective functions and networks are used to determine the optimal policy by Bellman’s iteration method within a sequential decision process. To illustrate the developed DSM, computational experiences from the field of natural resources are presented.

**MA-31**
**Discovery of patterns in data**
Stream: Data Mining
*Contributed session*

Chair: Takeaki Uno, National Institute of Informatics(NII), 101-8430, Tokyo, Japan, uno@nii.co.jp

1 - Mining the most representative models of patient care process with process mining methodology
Hongying Fei, Production and Operations Management, FUCAM (Catholic University of Mons), 151 chaussée de binche, 7000, Mons, Belgium, fei@fucam.ac.be, Nadine Meskens

In order to construct a process model for the purpose of evaluating and developing the care processes for a specific set of patients, we apply the process mining to this study to extract the most representative model of patient care process from a set of event data collected from a Belgian University Hospital. Instead of proposing a tool for designing processes, the main idea is to use the discovered process model as an objective start point to deploy systems that support care processes or as a feedback mechanism to check if the prescribed clinical pathways can fit the executed ones.

2 - High speed pattern mining for huge data - algorithm and implementation -
Takeaki Uno, National Institute of Informatics(NII), 101-8430, Tokyo, Japan, uno@nii.jp

Frequent pattern mining is the problem of finding all the frequently appearing patterns from huge databases, and is a central problem of data mining. We here present fast algorithms while straightforward algorithms need quite long time. We approached from the theoretical enumeration algorithm techniques, and developed several algorithms including one got the best award in an academic international competition. We briefly explain the techniques and the performance of the algorithms. The implementations are available at the author’s home page (http://research.nii.ac.jp/~uno/).

3 - A new algorithmic method for telecom event correlation using association rule mining
Behrad Analui, #500, 7th Floor, Entrance 13, Block A4, EKRATAN Residential Area, 1394743999, Tehran, Iran, Islamic Republic Of, behrad.analui@gmail.com

Event Correlation is a technique to examine relations between events received from different elements in telecom network in order to find and isolate the root cause and reduce the down time. For this purpose usually a set of rules is defined and applied to the coming events. In this paper we propose a new algorithmic method for defining rule sets based on association rule mining of historical events store in a database. This method is especially beneficial when applied to a large multi-vendor telecom network where adding a new element from a new vendor results in changing the whole rule set.

**MA-32**
**Banking**
Stream: Financial Modelling
*Contributed session*

Chair: Andreas Georgiou, Department of Business Administration, University of Macedonia, 156 Egnatia Street, 54006, Thessaloniki, Greece, acg@uom.gr

1 - Introducing a modified qfd design for quality improvement in the greek banking sector
Andreas Georgiou, Department of Business Administration, University of Macedonia, 156 Egnatia Street, 54006, Thessaloniki, Greece, acg@uom.gr,
2 - Determining the transition from open pit to underground mining

Alexandra Newman, Division of Economics and Business, Colorado School of Mines, 1500 Illinois Street, 80401, Golden, CO, United States, newman@mines.edu, Candace Yano

Extraction of an ore body can start as an open pit and may continue underground. Although tactical mine schedules often involve production blocks, we consider longer-term decisions of strata (i.e., many blocks at the same height). We specify which strata to mine above ground and when to mine these strata, when to begin installation of underground infrastructure, and which strata should be mined underground and when. We show how this integer program can be transformed into a series of networks, and present numerical results for a mine in South Africa using various discount rates.

3 - Strategic design of underground mine access, a gilbert arborescence problem

Doreen Thomas, Mechanical Engineering, University of Melbourne, Melbourne, 3010, Melbourne, Victoria, doreen.thomas@unimelb.edu.au

We investigate the problem of designing a minimum cost flow network interconnecting n-s sources and a single sink, each with known locations and flows. The network may contain additional nodes, known as Steiner points. We show that for concave increasing cost functions, a minimum cost network of this sort has a tree topology, and hence can be called a Minimum Gilbert Arborescence (MGA). We characterise the local topological structure of Steiner points in MGAs for linear cost functions. This problem has applications to the design of drains, gas pipelines and underground mine access.
Robustness. The technique is implemented through a case study of real option valuation. The paper presents a new method for real option valuation from fuzzy numbers that is based on findings from earlier real option valuation methods and from fuzzy real option valuation. The method is intuitive to understand and far less complicated than any previous real option valuation model to date.

**MA-35**

**Monday 08:00-09:20**  
GSI - S 9  
**Facilitated Decision Analysis**  
Stream: Facilitated Modelling Interventions  
**Invited session**  
Chair: Simon French, Manchester Business School, University of Manchester, Booth Street West, M15 6PB, Manchester, United Kingdom, simon.french@mbs.ac.uk

1. Developing MCDM tools for research project assessment  
   *Theodor Stewart*, Statistical Sciences, University of Cape Town, Upper Campus, 7701, Rondebosch, South Africa, theodor.stewart@uct.ac.za, K. Nadia Papamichail

The aim of this paper is to explore how decision analysts design and deliver decision workshops. We present a case study that discusses a decision making process unfolding in a research funding council in South Africa. A series of decision workshops was organised to develop MCDM tools for assessing research project applicants. Lessons learned and reflections on the study are presented.

2. Extending the use of scenario planning and MCDM: an application to food security in Trinidad & Tobago  
   *Camelia Ram*, Operational Research Group, London School of Economics, Houghton Street, WC2A 2AE, London, c.ram@lse.ac.uk, Gilberto Montibeller, Alec Morton

One way of coping with strategic uncertainty is exploring challenging futures or scenarios. There has been extensive research into how formal evaluation of strategic options given scenarios might be carried out in practice, but typically small numbers of scenarios are used. This paper presents a technique for efficiently developing a larger cohort of variable, qualitatively defined scenarios; and investigates how a multi-criteria framework can be applied to measure robustness. The technique is implemented through a case study of food security in Trinidad & Tobago in the next eight years.

3. Facilitated decision conferences in public participation:  
   *Simon French*, Manchester Business School, University of Manchester, Booth Street West, M15 6PB, Manchester, United Kingdom, simon.french@mbs.ac.uk

"You are charged with over-enthusiastic application of facilitated stakeholder workshops in the context of public participation. How do you plead?" "Guilty!" Driven by political imperatives to reduce a democratic deficit, there have been many applications of facilitated workshops in public participation to help public bodies shape and make societal decisions. In this paper I will discuss their use from the perspective of my experience and explain my concerns. I will argue that we need to evaluate our work in public participation much more scientifically than we have up until now.

**MA-36**

**Monday 08:00-09:20**  
GSI - S 11  
**Stochastic Control in Finance II**  
Stream: Optimal Control in Finance and Insurance  
**Invited session**  
Chair: Nicole Baeuerle, Institute for Mathematical Stochastics, University of Karlsruhe, Englersstr. 2, 76128, Karlsruhe, Germany, baeuerle@stoch.uni-karlsruhe.de

1. Asset allocation and liquidity breakdowns  
   *Peter Diesinger*, Department of Mathematics, University of Kaiserslautern, Erwin-Schrödinger-Straße, 67663, Kaiserslautern, Germany, diesinger@mathematik.uni-kl.de, Holger Kraft, Frank Thomas Seifried

We analyze the portfolio decision of an investor facing the threat of illiquidity, where illiquidity is understood as a state of the economy in which the investor is not able to trade at all. The efficiency loss due to illiquidity is addressed and quantified. For general utility functions, we show that the value function of a model in which only finitely many liquidity breakdowns can occur converges uniformly to the value function of a model with infinitely many breakdowns. The results are illustrated for an investor with a power utility function.

2. Impulse control of credit portfolios  
   *Roland Seydel*, MPI for Mathematics in the Sciences, Inselstrasse 22, 04103, Leipzig, seydel@mis.mpg.de, Ruediger Frey

In our talk, we present a case study of a bank in a Markov-switching economy that can reduce its loan exposure by discrete impulses. We start with a short introduction into the model and its real-world background. The value function of impulse control is associated with the (viscosity) solution of a PDE called quasi-variational inequality (QVI). This QVI is solved numerically, and practical insights and conclusions from the numerical results are discussed.

3. Investment, income, and incompleteness  
   *Holger Kraft*, Goethe-University, Frankfurt am Main, Germany, assetpricing@fianance.uni-frankfurt.de

The utility-maximizing consumption and investment strategy of an individual investor receiving an unspanned labor income stream seems impossible to find in closed form very difficult to find using numerical solution techniques. We suggest an easy procedure for finding a simple and admissible consumption and investment strategy which is near-optimal. We first explain and implement the strategy in a simple setting with constant interest rates, a single risky asset, and an exogenously given income stream, but we also show that the success of the strategy is robust.

4. Optimal investment in the foreign exchange market with proportional transaction costs  
   *Luitgard Veraart*, Department of Mathematics, Institute for Stochastics, University of Karlsruhe, Kaiserstr. 89, 76133, Karlsruhe, l.veraart@stoch.uni-karlsruhe.de

The utility-maximizing consumption and investment strategy of an individual investor receiving an unspanned labor income stream seems impossible to find in closed form and very difficult to find using numerical solution techniques. We suggest an easy procedure for finding a simple and admissible consumption and investment strategy which is near-optimal. We first explain and implement the strategy in a simple setting with constant interest rates, a single risky asset, and an exogenously given income stream, but we also show that the success of the strategy is robust.
We consider an investor in the foreign exchange market who can trade in two currencies, domestic and foreign. The investor seeks to optimise the expected mark—to—market value of the portfolio while aiming for a certain target proportion of the holdings in foreign currency compared to total wealth. This target proportion is exogenously given and can be thought of a constraint imposed by risk management. The exchange rate is modelled as a geometric Brownian motion. Proportional transaction costs are charged. We present a numerical algorithm which solves the resulting free boundary problem.

**MA-37**

*Monday 08:00-09:20*  
GSI - S 12

**Revenue and Demand Management**

Stream: Revenue Management

**Invited session**

Chair: Catalina Stefanescu, Management Science and Operations, London Business School, Regent’s Park, NW1 4SA, London, cstefanescu@london.edu  
Chair: Houyuan Jiang, Judge Business School, University of Cambridge, Trumpington Street, CB2 1AG, Cambridge, United Kingdom, h.jiang@jbs.cam.ac.uk

1 - Multivariate demand: modeling and estimation from censored sales  
Catalina Stefanescu, Management Science and Operations, London Business School, Regent’s Park, NW1 4SA, London, cstefanescu@london.edu

Current practice focuses on univariate demand forecasting, but in many industries there is evidence of correlated product demand. We propose a class of models for multi-product multiperiod aggregate demand forecasting, and develop an approach for estimating the parameters from censored sales data. We show that the algorithm is computationally attractive under different demand and censoring scenarios. We analyze two booking data sets from the entertainment and the airline industries, and show that these models increase the revenue by up to 11% relative to alternative forecasting methods.

2 - Choose-and-book: an electronic outpatient appointment system  
Houyuan Jiang, Judge Business School, University of Cambridge, Trumpington Street, CB2 1AG, Cambridge, United Kingdom, h.jiang@jbs.cam.ac.uk, James Z. Pang, Sergei Savin

Choose and Book is a national electronic referral system for outpatient appointments in England. The system gives patients a choice of appointment service provider, date and time. Choose and Book is instrumental in helping to measure and manage 18-weeks’ pathways for patients. We have identified a simple threshold policy and we have proved that this simple policy is optimal. We study montone proper- 

3 - Consumer choice modelling inputs into airline revenue management applications  
Tim Ryley, Department of Civil & Building Engineering, Loughborough University, Loughborough, Leicestershire, LE11 3LU, Loughborough, T.J.Ryley@lboro.ac.uk

Stated choice models have been developed from air travel household surveys in the East Midlands region of the UK; the focus is on leisure trips using low-cost airlines, and an aviation industry facing economic and environmental challenges. Logit-based models are estimated from a range of air travel attributes: fare, departure/arrival time, car parking charge, and a flight energy rating. Model outputs, such as forecasts using cost and time scenarios, across different consumer segments, are presented. These results can be input into more consumer-focused airline revenue management applications.

4 - Aggregating algorithm for pricing and capacity planning under uncertain demand  
Tatsiana Levina, School of Business, Queen’s University, 143 Union str, K7L 3N6, Kingston, Ontario, Canada, tlevin@business.queensu.ca, Yuri Levin, Mikhail Nediak, Vladimir Vovk

We study the problem of pricing and stocking of perishable items when demand and the reservation price distributions are unknown. The company learns consumer demand through successive observations over consecutive planning horizons, views the problem as a game against nature and applies Aggregating Algorithm to find the policies which are asymptotically optimal in the long run. The proposed methodology is general and independent of the form of the distributions.

**MA-38**

*Monday 08:00-09:20*  
GSI - S 13

**Bilevel Programming**

Stream: Variational Inequalities and Bi-Level Problems

**Invited session**

Chair: Stephan Dempe, Mathematics and Computer Sciences, Technische Universitaet Freiberg, 09596, Freiberg, Germany, dempe@math.tu-freiberg.de

1 - Fuzzy necessary optimality conditions for bilevel set optimization problems  
Nazih Abderrazzak Gadhi, Department of Mathematics Dhar Em Mehrez, Sidi Mohammed ben Abdellah University, B.P. 3536 Marrakech Amerchich, 40000, Marrakech, ngadhi@hotmail.com, Stephan Dempe

In this paper, using an extremal principle introduced by Morekovich, we establish optimality conditions for a bilevel set valued optimization problem. Intermediate set valued optimization problems are introduced to help us in our investigation.

2 - The pessimistic approach for a bilevel problem with linear lower level  
Sebastian Lohse, Institut für Num. Mathematik und Optimierung, TU Bergakademie Freiberg, 09596 Freiberg, 09599, Freiberg, lohse@math.tu-freiberg.de

We consider a bilevel programming problem with linear lower level and with a special structure of the set of parameters — one set of right-hand-side parameters and one set of objective function parameters. At first it is shown, that a global pessimistic solution always exists even without lower semicontinuity of the optimal solution mapping. Examples will prove, that our assumptions are necessary. In the second part an algorithm is presented under additional assumptions using an idea of Fukuda and Terlaky for vertex enumeration of a polyhedron.
3 - Feasible direction method for bilevel programming problem

Ayalew Mersha, Mathematics and Informatics, TU Freiberg, Am Mühleitche 6, 09590, Freiberg, Sachsen, ayalew@math.tu-freiberg.de

In this talk, we investigate the application of feasible direction method for an optimistic nonlinear bilevel programming problem. The convex lower level problem of an optimistic nonlinear bilevel programming problem is replaced by relaxed KKT conditions. The feasible direction method developed by Topkis and Veinott is applied to the auxiliary problem to get a Bouligand stationary point for an optimistic bilevel programming problem.

4 - A bilevel matroid problem

Diana Fanghaeneel, Institut für Informatik, Universität zu Köln, Pohlgr. 1, 50969, Köln, Germany, fanghaeneel@ informatik.uni-koeln.de

We investigate a bilevel matroid problem, where a matroid is given and different weight vectors for the decision makers. At this, the follower determines an independent set of the matroid with maximum weight. The leader’s weight of this independent set gives the objective function value of the leader. To influence the chosen independent set, the leader can increase the weights of the follower, but in return for the increase he has to pay a penalty. We want to present solution algorithms to determine the optimal decision of the leader for several matroids.
This study aims to clarify how supply chain collaboration affects the organizational security culture of supply chain members. Variables of institutional theory and security culture evolution are employed to be the interorganizational driving factors and the inside organizational effects. Social exchange theory will be used as the bridge to connect the interorganizational cause and the intraorganizational change. The relationships between the cause and effect are tested herein. The results indicate what culture change firms will make under certain supply chain collaborative factors.

This paper presents a two-stage stochastic program with recourse for breeding farms. The proposed model considers a medium-term planning horizon and specifically allows an optimal replacement and schedule of purchases to be obtained for the first stage. This model takes into account the uncertainty present in some parameters, such as litter size, mortality and fertility, explicitly incorporated via a finite set of scenarios. The proposed model is solved by using the algebraic modelling software OPL Studio, in combination with the solver CPLEX to solve the different instances considered.

**MA-41**

Monday 08:00-09:20  
GSI - S 28

**OR in Agriculture and Forest Management I**

Stream: OR in Agriculture and Forest Management  
Invited session

Chair: Lluís M Pla, Mathematics, University of Lleida, JaumeII, 73, 25001, Lleida, Spain, lmpla@matematica.udl.es

1 - Modelling classical swine fever spread using a spatial hybrid model  
Benjamín Ivorra, University of Lleida, Pont de l'abadia, 3, 28040, Madrid, Spain, ivorra@mat.ucm.es, Angel Manuel Ramos, Beatriz Martinez-Lopez, Jose Manuel Sanchez-Vizcaino

Classical swine fever (CSF) is a highly contagious viral disease of pigs that causes severe commercial restrictions to the affected countries. During this talk, we introduce a spatial hybrid model (SHM) developed for the spread of CSF. It is based on the combination of a stochastic 'Individual Based' model (modelling the farm to farm evolution of the spread), with a deterministic 'SIR' model (modelling the intra-farm evolution of the spread). The parameters of the models are estimated using real data. The SHM is validated and results are compared to those obtained with other models.

2 - Incorporation of clinical signs for characterization of individual sows in the sow replacement problem  
Sara Verónica Rodríguez-Sánchez, Mathematics, University of Lleida, 25001, Lleida, Spain, srodriguez@matematica.udl.cat, Tina Jensen, Lluís Miquel Pla, Anders Kristensen

The current high mortality in Danish sow herds is not only regarded as an economical problem, but also a significant animal welfare problem. Coping with the increased mortality is therefore given high priority. The aim of this study is to incorporate a weak sow index (WSI) used to characterize clinical signs into an existing sow replacement model thus taking the clinical signs into account when optimal replacement policies are determined. The effects of the WSI on the optimal replacement policies will be studied, and the economic value of the individual clinical observations will be calculated.

3 - A two-stage stochastic program for production planning in breeding farms  
Lluís Miquel Pla, Mathematics, University of Lleida, Fac. Dret i Economia, Jaume II, 73, 25001, Lleida, lmpla@matematica.udl.cat, Sara Verónica Rodríguez-Sánchez, Victor Albornoz

**MA-42**

Monday 08:00-09:20  
GSI - S 3

**Optimal Control III**

Stream: Optimal Control  
Invited session

Chair: Shahlar Maharramov, math, Yasar university, Selcuk yasar camp, Univers.str, No:35-37, Bornova, 35500, Izmir, Turkey, shahlar.maharramov@yasar.edu.tr

1 - Stochastic optimal control and stochastic DNS sets: exemplified by a model of illicit drug markets  
Roswitha Bultmann, Institute for Mathematical Methods in Economics (IWM), Research Unit for Operations Research and Nonlinear Dynamical Systems (ORDYS), Vienna University of Technology, Argentinierstr. 8/105-4, A-1040, Vienna, bultmann@tuwien.ac.at, Gernot Tragler

Skiba or DNS sets are an important characteristic of many deterministic optimal control models. They may occur if the optimized system exhibits multiple equilibria. However, multiple equilibria and DNS sets in stochastic optimal control models have hardly been studied so far. By taking well-known deterministic models that exhibit history dependence as our starting point and reformulating these models in a stochastic setting, we are able to get a better understanding of stochastic DNS sets and their properties. We illustrate our findings by a model of illicit drug markets.

2 - Indifference prices for CO2 emission allowances  
Olivier Davidaux, Center for Applied Mathematics, Mines ParisTech, Rue Claude Daunesse - B.P. 207, 06904, Sophia Antipolis Cedex, France, olivier.davidaux@cma.ensmp.fr, Mireille Bossy, Nadia Maïzi, Pourtallier Odile

An electricity producer involved in the European Emission Trading Scheme has to estimate the price under which he decides to buy allowances. His preferences are represented by an utility function of his terminal wealth which he tries to maximize in an uncertain environment. If his emissions during the period exceeds his allowances he has to pay a tax. So we have to resolve a stochastic control problem, the control of the producer being the amount of electricity he produces. The uncertainty factors arise from the stochastic structure of electricity prices which produces spikes.

**MA-43**

Monday 08:00-09:20  
GSI - S 10

**Portfolio and Risk Management I**

Stream: Long Term Financial Decisions  
Invited session

Chair: Ettore Croci, Faculty of Economy, Dipartimento di Science, University of Milan-Bicocca, 20126, Milan, Italy, ettore.croci@unimib.it
We consider parametric linear-quadratic optimal control problems taking into account both the minority investors' point of view and our procedures in Germany, using a brand-new database of squeeze-out procedures in Germany. We provide a cost-benefit analysis of the current squeeze-out procedures and offer new insights on this procedure. To facilitate delistings of stock companies after an acquisition, national legislations in Europe give firms who own a large fraction of the targets' equity capital the right to acquire the remaining outstanding shares. Squeeze-out offers has been used extensively in Germany. We provide a cost-benefit analysis of the current squeeze-out procedures in Germany, using a brand-new database of squeeze-outs with unique data, and offer new insights on this procedure taking into account both the minority investors' point of view and firms' strategies.

1 - Optimal asset allocation and sharing rule for pension funds with stochastic force of mortality and demographic assets

Francesco Menoncin, Economics, Brescia University, Via S. Faustino, 74/B, 25122, Brescia, Italy, menoncin@eco.unibs.it

We study both the optimal asset allocation and the optimal share of performances for a pension fund which operates in a complete financial market where the prices of risky assets are driven by some stochastic state variables. Furthermore, we take into account a stochastic force of mortality whose risk (i.e. both mortality and longevity risk) can be hedged through a demographic asset as a derivative on this force of mortality. The framework is useful for both a defined contribution and a defined benefit pension scheme.

2 - Minority squeeze-out regulation in Germany — efficiency, fairness, and economic consequences

Ettore Croci, Faculty of Economy, Dipartimento di Science, University of Milan-Bicocca, 20126, Milan, Italy, ettore.croci@unimib.it, Olaf Ehrhardt

To facilitate delistings of stock companies after an acquisition, national legislations in Europe give firms who own a large fraction of the targets’ equity capital the right to acquire the remaining outstanding shares. Squeeze-out offers has been used extensively in Germany. We provide a cost-benefit analysis of the current squeeze-out procedures in Germany, using a brand-new database of squeeze-outs with unique data, and offer new insights on this procedure taking into account both the minority investors’ point of view and firms’ strategies.

MA-45

Monday 08:00-09:20
GSI - S 33

Analysis of Deterministic and Stochastic Discrete Systems 1

Stream: Discrete Optimal Control

Invited session

Chair: Dmitrii Lozovanu, Institute of Mathematics and Computer Science, Academy of Sciences of Moldova, Academy of Sciences, Vavilova 40, 119333, Moscow, Russian Federation, Alla Albu, Applied optimization problems, Dorodnicyn Computing Centre of Russian Academy of Sciences, Vavilova 40, 119333, Moscow, Russian Federation, alla.albu@mail.ru, Vladimir Zubov

An effective method is proposed to calculate the cost function gradient in a complex optimal control problem for the substance crystallization process. The method is based on the Fast Automatic Differentiation methodology (FAD), which makes it possible to calculate the precise value of the gradient of the cost function for the selected approximation of the optimal control problem. The given example shows that the application of FAD-methodology is a necessary and inevitable element of the solution of complex optimal control problems. This work was supported by RFBR (08-01-90100-Mol_a).

2 - Study and modification of the fast automatic differentiation technique

Vladimir Zubov, Mechanics of continuum media, Dorodnicyn Computing Centre of Russian Academy of Sciences, Vavilova 40, 119333, Moscow, Russian Federation, zubov@ccas.ru, Andrey Albu
It is shown that the numerical solution of the discrete optimal control problem derived using the FAD technique doesn’t always converge to the exact solution of the optimal control problem for any approximation of the cost functional if the approximation of connections is prescribed. A modification of FAD is proposed where such matched approximations of the cost functional and differential connections are used that the obtained discrete adjoint problem approximates the continuous adjoint problem. This work was supported by RFBR (o 08-01-90100-Mol_a).

Monday 09:45-11:45

MB-01

Monday 09:45-11:45
Maritim

Opening Session

Stream: Plenaries

Plenary session

Chair: Gerhard J. Woeginger, Department of Mathematics and Computer Science, Eindhoven University of Technology, 5600 MB, Eindhoven, Netherlands, gwoegi@win.tue.nl

Chair: Erwin Pesch, FB 5, University of Siegen, Hoelderlinstr. 3, 57068, Siegen, Germany, erwin.pesch@uni-siegen.de

1 - Opening session

1. Beethoven’s “Song of Joy”
2. Welcome speeches - President of EURO - Mayor of Bonn - President of GOR
3. General remarks
4. Announcements of GOR Awards - Winner of GOR Science Award - Winner of GOR Doctoral Dissertation Award
5. Announcement of EURO Awards - Finalists of EURO Doctoral Dissertation Award - Winner of EURO Distinguished Service Award
6. EURO Gold Medal - Introduction and appraisal of the winner - Presentation by the winner
7. Practical guidelines for the conference
Precidence-constrained scheduling and graph optimization problems

Stream: Combinatorial Optimization

Invited session

Chair: Valery Gordon, United Institute of Informatics Problems, Surganov str. 6, 220012, Minsk, Belarus, gordon@newman.bas-net.by

1 - On Hamiltonian properties of triangular grid graphs

Valery Gordon, United Institute of Informatics Problems, Surganov str. 6, 220012, Minsk, Belarus, gordon@newman.bas-net.by, Yury Orlovich, Frank Werner

Cyclic properties of triangular grid graphs are considered. Such properties are important in applications connected with problems arising in molecular biology, in telecommunications and in the design of cellular networks. We prove that all connected, locally connected triangular grid graphs (with the only one exception of a special 13-vertices graph) are fully cycle extendable. We also show that the hamiltonian cycle problem for triangular grid graphs, in general case, is NP-complete, but a hamiltonian cycle in connected, locally connected triangular grid graph can be found in polynomial time.

2 - A monotone approximation algorithm for scheduling with precedence constraints

Rob van Stee, AG1, MPI Informatik, Campus E1 4, 66123, Saarbrücken, vansteer@mpi-inf.mpg.de, Sven Krumke, Anne Schwahn, Stephan Westphal

In this paper, we consider the problem of scheduling jobs in a multiprocessor setting where there are precedence constraints between tasks, and where the performance measure is the makespan, the time when the last task finishes.

We consider the version of this problem where the machines are related: each machine has a speed at which it runs, which does not depend on the job being run. In our model, each machine belongs to a selfish user. We provide a monotone (i.e. truthful) approximation algorithm.

3 - Periodic schedules for linear precedence constraints: algorithms and questions

Claire Hanen, Université de Paris 10 Nanterre, LIP6, 200 avenue de la République, 92001, Nanterre, France, claire.hanen@u-paris10.fr, Alix Munier-Kordon

We adress a cyclic scheduling problem in which tasks have to be repeated infinitely often and are subject to linear precedence constraints. We first consider a subclass of schedules, periodic schedules and we build polynomial algorithms to check existence and to compute their optimal throughput. We then introduce a second subclass which dominates the previous one, quasi-periodic schedules, and we derive pseudo polynomial algorithms. We then discuss the ratio between the optimal periodic (or quasi-periodic) throughput and the optimal throughput.

4 - On eulerian extension problems and their application to sequencing problems

Wiebke Höhn, Institut für Mathematik, Technische Universität Berlin, Straße des 17.Juni 136, 10623, Berlin, Germany, hoehn@math.tu-berlin.de, Tobias Jacobs, Nicole Megow

We present a new technique for investigating the complexity of sequencing problems such as the Gilmore-Gomory type Traveling Salesman Problem and related flowshop scheduling problems. We show that those sequencing problems have a natural interpretation as Eulerian Extension Problems which leads to new structural insights and solution methods. In fact, our method provides the entire set of optimal solutions, instead just a single one. Besides the theoretical significance, this is meaningful to practical applications in which often a secondary optimization criteria plays a role.

Methods for Vehicle Routing and Scheduling

Stream: Transportation Planning

Invited session

Chair: Stefan Irnich, Deutsche Post Endowed Chair of Optimization of Distribution Networks, RWTH Aachen University, Templergraben 64, 52062, Aachen, Germany, sirnich@or.rwth-aachen.de

1 - Cutting on the set partitioning formulation of the vehicle routing problem with time windows

Simon Spoorendonk, DIKU, Department of Computer Science, University of Copenhagen, Universitetsparken 1, 2100, Copenhagen O, Denmark, spooren@di.ku.dk

In recent papers cutting planes derived from the set partitioning formulation of the VRPTW have shown to be very successful. In a column generation context cutting planes on the master problem formulation can complicate the subproblem significantly. This is due to a possible augmentation of variables and constraints that may be needed to in order to compute the correct reduced cost of a column. We discuss the impact of such an augmentation and show how to apply set partitioning derived cuts (Chvatral-Gomory rank-1 cuts and clique inequalities) in a column generation algorithm for the VRPTW.

2 - Partial path column generation for the vehicle routing problem with time windows

Bjørn Petersen, DIKU, Department of Computer Science, University of Copenhagen, Universitetsparken 1, 2100, Copenhagen, Denmark, bjorn@di.ku.dk

Traditionally, column generation models of the VRPTW have consisted of a set partitioning master problem with each column representing a route, starting and ending at the depot. Elementary routes have shown to be superior on difficult instances. However, the pricing problems do not scale well when the number of feasible routes increases. We suggest to relax that ‘each column is a route’ into ‘each column is a partial path of the giant tour’. This way, the length of the partial path can be bounded and a better control of the size of the solution space for the pricing problem can be obtained.

3 - On approximation algorithm for some stochastic vehicle routing problems

Anastasia Shakhshneyder, Mechanic-Mathematical department, Novosibirsk State University, st. Pirogova 2, Novosibirsk, Russia, 630090, Novosibirsk, Russian Federation, a.shakhshneyder@gmail.com, Edward Gimadi

Traditionally, column generation models of the VRPTW have consisted of a set partitioning master problem with each column representing a route, starting and ending at the depot. Elementary routes have shown to be superior on difficult instances. However, the pricing problems do not scale well when the number of feasible routes increases. We suggest to relax that ‘each column is a route’ into ‘each column is a partial path of the giant tour’. This way, the length of the partial path can be bounded and a better control of the size of the solution space for the pricing problem can be obtained.
We consider k-customer vehicle routing problem with equally distributed independent random instances. We analyze the case of one depot and multi-depot problem. We construct the polynomial approximation algorithms to solve these problems using the procedure “Nearest city”. We apply the probabilistic analysis of the algorithms. As a result we obtain the estimates of relative error, failure probability and the conditions when the algorithms are asymptotically optimal. All results are valid for directed and undirected graphs. This work is supported by RFBR (projects 08-01-00516, 07-07-00222).

4 - Efficient constraint handling in heuristic and exact vehicle routing

Stefan Irnich, Deutsche Post Endowed Chair of Optimization of Distribution Networks, RWTH Aachen University, Templergraben 64, 52062, Aachen, Germany, sirnich@or.rwth-aachen.de

Efficient constraint checking is crucial in heuristics and exact algorithms for vehicle routing. A uniform way of stating constraints is resources. The update of resources along a route can be done with resource extension functions (REFs). We survey the key properties that REFs should have in order to guarantee efficient local search and efficient pricing in column-generation algorithms. Pricing based on shortest-path computations requires particular properties of REFs. We exemplify our theoretical findings by discussing several types of standard as well as non-standard constraints.

3 - Metaheuristic solution methods for waste collection problems

Vera Hemmelmayr, Department of Business Administration, University of Vienna, Burenner Straße 72, 1210, Vienna, Austria, vera.hemmelmayr@univie.ac.at, Karl Doerner, Richard Hartl

In this talk we consider a real world waste collection problem. In many cities, towns and villages specific types of waste are collected in public waste collection points. The bins at this waste collection points have to be emptied on a regular basis. For each type of waste fixed tours have to be calculated for a fixed planning horizon. The problem is modeled as a Periodic Vehicle Routing Problem with Intermediate Facilities (PVRP-IF). We propose solution methods based on Variable Neighborhood Search.

4 - Application of reverse logistics to construction and demolition waste collection planning

Nicole Sunke, Chair of Business Administration, Construction Management and Economics, University of Siegen, Paul-Bonatz-Str. 9-11, 57068, Siegen, Germany, nicole.sunke@uni-siegen.de, Frank Schultmann

A huge potential for sustainable construction can be found in the appropriate treatment of construction and demolition waste (C&D waste). However, reverse logistic problems for the collection C&D waste have fairly been neglected so far. These planning problems will be highlighted from the perspective of the main actors in the collection process. Constraints on the planning problems will be addressed and models for reverse logistics and necessary modifications in dependency on the type of material and actor involved will be discussed.

4 - A tabu search heuristic algorithm for the waste collection vehicle routing problem with time windows (vrptw)

Aida Mauziah Benjamin, CARISMA, Brunel University, John Crank Building, UBB 3PH, Uxbridge, United Kingdom, Aida.Benjamin@brunel.ac.uk, J. E. Beasley

In this problem it is assumed that there is a single depot, a set of waste disposal sites, a set of customers at which waste is collected and an unlimited number of homogeneous vehicles. Besides, we also take into consideration a driver rest period. The nearest neighbour greedy technique is used to obtain an initial solution. Next, we use a neighbour set algorithm to improve the solution, followed by a tabu search phase. The algorithm is tested on ten publicly available waste collection VRPTW benchmark problems. The results obtained compare well with other results presented in the literature.
We develop a decomposition method for the Time-Constrained Project Scheduling Problem (TCPSP) with Adjacent Resources (AR). For AR the resource units are ordered and the units assigned to a job have to be adjacent. On top of that, ARs are not required by single jobs but by job groups. As soon as a job of such a group starts, the AR units are occupied, and they are not released before all jobs of that group are completed. The developed decomposition method separates the AR assignment from the rest of the scheduling problem. Test results demonstrate the applicability of the decomposition method.

2 - Time-constrained project scheduling

Marco Schutten, MB / OMPL, University of Twente, P.O. Box 217, 7500 AE, Enschede, Netherlands, m.schutten@utwente.nl, Tom Guldemond, Jacob Jan Paulus, Johann Hurink

We present an approach for scheduling with deadlines and apply this approach to the Time-Constrained Project Scheduling Problem. To be able to meet these deadlines, it is possible to work in overtime or hire additional capacity. For this problem, we develop a 2-stage heuristic. In the first stage we construct partial schedules in which jobs may be scheduled for a shorter duration than required. The second stage uses an ILP formulation to turn a partial schedule into a feasible schedule, and to perform a neighborhood search. We present experimental results on modified RCPSp benchmark instances.

3 - Stochastic scheduling subject to preemptive-repeat breakdowns with incomplete information

Xiao-qiang Cai, Department of Systems Engineering and Engineering Management, The Chinese University of Hong Kong, Shatin, NT, Hong Kong, Hong Kong, xqc@se.cuhk.edu.hk, Xianyi Wu, Xian Zhou

We study the problem of scheduling a set of jobs on a single machine subject to stochastic breakdowns, where a machine breakdown causes the loss of the work done on the job being processed. The processing times, the machine uptimes, and the machine downtimes, are random variables with incomplete information on their probability distributions characterized by unknown parameters. We derive the optimal static and dynamic policies. As a by-product, we also show that our incomplete information model subsumes the traditional models with complete information as extreme cases.

4 - Throughput optimization in two-machine flowshops with flexible operations

Yves Crama, HEC - Management School, University of Liège, Boulevard du Rectorat 7 (B31), 4000, Liège, Belgium, y.crama@ulg.ac.be, Hakan Gultekin

We consider a two-machine flowshop which produces identical parts. Each part requires a number of operations. Some of these operations (called flexible operations) can be performed on either machine, while others are preassigned to one of the machines. The same flexible operation can be performed on different machines for different parts. The problem is to determine the assignment of the flexible operations to the machines for each part, in order to maximize the throughput rate. We consider various cases depending on the number of parts and the capacity of the buffer between the machines.

1 - Survival models based on logical analysis of data and community detection

Julien Darlay, Laboratoire G-SCOP, 46, avenue Félix Viallet, 38031, Grenoble, France, julien.darlay@g-scop.inpg.fr, Nadia Brauner

Logical Analysis of Data (LAD) is a supervised learning method based on combinatorial optimization. It was recently adapted to survival analysis where one wants to predict a time to event with possible censored data (only a lower bound on the time to predict is known). LAD method relies on the concept of patterns that describe observations with close survival properties. Our objective is to identify similar patterns in order to be able to choose the “better” ones. We use graph theory modeling this problem with clique partitioning and community detection.

2 - Role of graphs in protein structure analysis

Maciej Milostan, Institute of Computing Science, Technical University of Poznan, 60-965, Poznan, Poland, maciej.milostan@cs.put.poznan.pl, Jacek Blazewicz, Piotr Lukasiak

Probably one of the most important scientific tasks in a structural biology is to analyze structural and functional features of proteins. Popular approach in such analysis is to represent the properties of protein molecules in form of graphs, e.g. contact graphs, surface graphs etc., and then analyze these graphs by common OR methods. Various kinds of graph analysis algorithms can be applied to tackle different problems in context of proteins. We show the methods of construction of protein graphs based on various contacts definitions and show an overview of their potential applications.

3 - Bspred method — the new approach used for predicting

Piotr Lukasiak, Institute of Computing Science, Poznan University of Technology, ul.Piotrowo 2, 60-965, Poznan, Poland, Piotr.Lukasiak@cs.put.poznan.pl, Jacek Blazewicz, Arkadiusz Hoffa, Maciej Antczak

The new method of binding sites prediction called BSPred has been proposed. Identifying the interface between the interacting protein and another molecule provides important clues to the function of a protein and can be useful in complex structures prediction. The BSPred approach predicts protein binding sites based on protein-ligand sequential context templates extracted from the known, crystal structures from the Protein Data Bank. Based on the data from CASP8 accuracy of prediction is on the level higher than 60%. Proposed approach can be successfully applied for the considered problems.
1 - Evolutionary approaches to maximizing the self-availability in a chaotic warehouse

Sacramento Quintanilla, Economía Financiera y Matemática, Universidad de Valencia, Avda. Naranjos s/n, 46071, Valencia, Spain, Maria.Quintanilla@uv.es, Francisco Ballestin, M.Pilar Lino, M. Angeles Pérez, Vicente Valls

The logistic distribution is an important link in the company value chain. The application of recent technologies like RFID allows an easier management of chaotic warehouses in real time. In this context we introduce some algorithms to obtain the optimal location of the current stock and the in/out products. A defrag approach is designed to relocate the stock when the best and the current self-availability differ too much. In all the algorithms we take into account the m3, some criteria for high rotation items and / or dangerous products. We distinguish two cases: fixed and no fixed layout.

2 - Simuroute: using Monte Carlo simulation and splitting techniques to produce a solutions set to the cvrp

Javier Faulín, Department of Statistics and OR, Public University of Navarre, Los Magnolios Building, 1st Floor, Campus Arrosadia., 31006, Pamplona, Navarra, Spain, javier.faulin@unavarra.es, Angel A. Juan, Scott Grasman, Fernando Lera-Lopez

Given a Capacitated Vehicle Routing Problem-CVRP instance, the SimuRoute algorithm incorporates a randomness criterion to the classical Clarke and Wright Savings heuristic and starts an iterative process in order to obtain a set of alternative solutions, each of which outperforms the CWS algorithm. We also incorporate splitting techniques to enhance the method performance. Therefore, our methodology provides more flexibility during the routing selection process, which may help to improve the quality of service offered to clients.

3 - Determination of the transport and delivery capacity in a postal company

Manuel Mateo, Department Business Administration, Universitat Politècnica Catalunya, Avda Diagonal, 647, 7th, E-08028, Barcelona, Spain, manel.mateo@upc.edu, Paolo Gaianigo, Imma Ribas

A private postal company had to determine the capacity of the transport and delivery, two bottlenecks of its process. The transport in metropolitan areas of Madrid and Barcelona is analyzed and a new organization is proposed to face an increase of demand. Delivery is the process that enables the arrival of mail at the destination. The study is based on historical and practical data. The objective is to develop a model which can predict the quality level in terms of the quantity of work and the number of resources needed. The model helps to decision-making according to strategic objectives.

4 - A tabu search approach for the green cvrp

Javier Faulín, Department of Statistics and OR, Public University of Navarre, Los Magnolios Building, 1st Floor, Campus Arrosadia., 31006, Pamplona, Navarra, Spain, javier.faulin@unavarra.es, Francisco Arcelus, Sergio Ubeda

We describe a new application of the well-known tabu search approach to solve CVRP with environmental criterion minimisation. This criterion is based on the calculation of CO2 emissions, which is highly dependent on several factors such as speed, load and distance. A case study is given to show how green routes can be obtained and to analyses whether those routes also meet the efficiency objectives or not. The results show that the tabu search approach adapts to the environmental criteria better than heuristics and also produces routes which are distance effective and cleaner.

MC-07

Monday 12:00-13:20

GSI - S 29

Rescheduling in railways

Stream: Optimization in Public Transport

Chair: Marco Laumanns, Institute for Operations Research, ETH Zurich, Raemistrasse 101, 8092, Zurich, Switzerland, laumanns@ifor.math.ethz.ch

1 - Precise operation — accurate and fast rescheduling: potential benefits and challenges in the field of railway operations research

Marco Lüthi, Inst. for Transport Planning and Systems, ETH Zurich, Wolfgang-Pauli-Str. 15, 8093, Zurich, Switzerland, luethi@itv.baug.ethz.ch

Rail traffic has grown significantly within the last few years. To handle the more and more dense traffic efficiently, even in case of delays or incidents, research focuses on developing strategies and algorithms in order to calculate new schedules in real-time. However, developing an automated dispatching system for a mixed traffic railway network is very difficult and the implemented models so far are not satisfying all complex and detailed requirements. Some of the most demanding challenges, possible performances and quality improvements will be demonstrated in this presentation.

2 - Design of an effective algorithm for fast response to the re-scheduling of railway traffic during disturbances

Johanna Törnquist Krasemann, School of Engineering, APS, Blekinge Institute of Technology, Box 520, 37225, Ronneby, johanna.tornquist@bth.se

The increased occurrence of railway traffic disturbances shows that effective re-scheduling is important. In previous research we have designed an optimization-based approach which seems promising. However, for some scenarios it is difficult to find good solutions within seconds. Therefore, we have developed a greedy algorithm which effectively delivers good solutions within the permitted time. To quickly retrieve a feasible solution the algorithm performs a depth-first search using an evaluation function to prioritise when conflicts arise and then branches according to a set of criteria.

3 - A model for real-time-dispatching of connection conflicts in railway operation

Stephan Kurby, DB Netz AG / Technische Universität Dresden, Schweizer Strasse 3b, 01069, Dresden, Germany, stephan.kurby@dbnetze.com, Matthias Bär
The shown approach is a contribution to the real-time-dispatching in railway operation. Developed was a macroscopic decision model to minimize the weighted follow-up costs of the connection-decisions (delay of connection-holding trains versus connection is not held). At the local decision the resulting effects to the net will be considered according to their relevance. A microscopic dispatching system does check and improve the macroscopic located solutions. The result shall be a conflict free, workable and robust dispatch schedule which can immediately enter live railway operation processes.

4 - Impact of rescheduling trains with transfer connections in disturbed traffic conditions

Marco Pranzo, Dipartimento di Ingegneria dell’Informazione, Università di Siena, Siena, Italy, pranzo@idi.uni.sns.it, Francesco Corman, Andrea D’Ariano, Dario Pacciarelli
Train conflict detection and resolution is the problem of minimizing deviations from the timetable while satisfying rail operational constraints. This paper presents a novel methodology to determining the wait or no wait decision of transfer connections when rescheduling trains in presence of disturbances. We formulate the scheduling problem via alternative graphs and develop algorithms to improve punctuality and get reliable transfer connections. A computational study on a complex and densely occupied network is carried out to assess which connections are more critical to delay management.

3 - Train scheduling for large and highly utilized railway networks

Gabrio Curzio Caimi, Institute for Operations Research, ETH Zurich, HG G21.2, Rämistrasse 101, 8092, Zurich, Switzerland, caimi@ifor.math.ethz.ch, Marco Laumanns, Martin Fuchsberger, Kaspar Schüpbach
We consider the generation of conflict-free train schedules in large congested railway networks. First, on the macro level we propose an extension of the well-known PESP model using a simplified track topology to create a flexible timetable. On the micro level, this flexibility helps obtaining a solution when checking for feasibility, considering the detailed topology locally. There, we propose a resource constrained integer multicommodity flow model that enables to precisely and efficiently detect potential conflicts, and generates much stronger bounds compared to previous formulations.

4 - A bundle approach for solving large scale train timetabling problems

Thomas Schlechte, Optimization, Zuse-Institute-Berlin, Takustrasse 7, 14195, Berlin, Berlin, Germany, schlechte@zib.de, Ralf Borndörfer, Steffen Weider
This talk focuses on the macroscopic train timetabling problem (TTP), which consists in finding a conflict free set of train routes of maximum value in a given railway network. We model the (TTP) as a large scale integer program and solve it by a Branch and Bound and Price approach. Furthermore we present in detail the computational improvement by using the bundle method to solve a Lagrangian Relaxation instead of a LP Relaxation. All experiments are performed on scenarios for a part of the German long distance area; available at ttplib.zib.de.

MC-08 Monday 12:00-13:20
GS I - S 30
Railway planning

Stream: Optimization in Public Transport
Invited session
Chair: Dennis Huisman, Econometric Institute, Erasmus University, Rotterdam, Netherlands, huisman@few.eur.nl

1 - The line planning game for railway systems

Anita Schoebel, Fakultät für Mathematik, Georg-August Universität Göttingen, Lotzestrasse 16-18, 37083, Göttingen, Germany, schoebel@math.uni-goettingen.de, Silvia Schwarze
We present a game-theoretic model for the line planning problem in public transportation, in which each line acts as player. Each player aims to minimize its own delay, which is dependent on the traffic load along its edges. We show that there exists a line plan at equilibrium, which minimizes the sum of delays of the transportation system. This result is achieved by showing that a potential function exists. Moreover, we propose methods for calculating equilibria and present numerical results in which we compare our approach to other line planning models.

2 - Simultaneous railway line planning and network design

Ángel Marín, Matemática Aplicada, Universidad Politécnica de Madrid, E.T.S.Ingenieros Aeronáuticos, Plaza Cardenal Cisneros, 3, 28040, Madrid, Spain, angel.marin@upm.es, Federico Perea, Juan A. Mesa
Network Design (ND) decides the network (tracks and stations). Line Planning (LP) decides the configuration of lines, including their frequencies. To obtain the robustness of complex systems different concepts of robustness are considered. They must be studied at each planning level and in a global way, trying to increase the system efficiency in presence of failure. We combine ND and LP into one unique problem. Given that the unique model may be computationally intractable, we present an iterative approach dealing with the robustness of the integrated problem.
We propose a generalized framework for surrogate-assisted hybrid multi-objective optimization algorithm, where an evolutionary search is complemented with a local search algorithm (sequential quadratic programming). Instead of using a single model, or a single ensemble, the local search algorithm uses two sets of surrogates, one global model that aims at a global modeling of the fitness landscape, and an ensemble model that consists of different types of models for exact approximation of the local fitness function.

3 - Finding the best fixed-size pareto front approximation
Marco Laumanns, Institute for Operations Research, ETH Zurich, Raemistrasse 101, 8092, Zurich, Switzerland, laumanns@ifor.math.ethz.ch, Rico Zenklusen

We address the problem of approximating the Pareto front of multi-objective optimization problems with a fixed number of points. We show that already for three objectives it is NP-hard to find the best approximation set of given size. For the online version, where we are given the search points sequentially, we present an archiving scheme producing a sequence of approximation sets that converges almost surely to a best possible approximation set of given size. We also propose a simple alternative scheme that guarantees convergence of a fixed-size set of sub-optimal approximation quality.

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**MC-11**
Monday 12:00-13:20
GSI – S 17

**Portfolio Decision Analysis: Cases and Applications I**

**Stream: Multiple Criteria Decision Analysis**

**Invited session**

Chair: Alec Morton, Management/Operational Research, London School of Economics, Houghton St, London, wc2a2ae, London, England, United Kingdom, a.morton@lse.ac.uk

Chair: Ahti Safo, Systems Analysis Laboratory, Helsinki University of Technology, P.O. Box 1100, Otakaari 1 M, 02015, TKK, Finland, ahti.sajo@tkk.fi

Chair: Jeff Keisler, Boston College of Management, University of Massachusetts, 100 Morrissey Blvd., 02125-3393, Boston, MA, United States, jeff.keisler@umb.edu

1 - Robust portfolio methods for counterterrorism resource allocation
Don Kleinmuntz, Strata Decision Technology & Univ of Southern California, 2001 South First Street, Suite 200, 61820, Champaign, IL, United States, dnk@strata-decision.com

Terrorism risk requires cost-effective prioritization of countermeasures. This presentation describes a decision analysis approach that is useful when decision makers have deadlines, limited data, and few analytical resources, showing how robust portfolio optimization methods can guide efforts to gather more complete information on vulnerable targets and potential corrective measures. Analyses performed for the California Governor’s Office of Homeland Security demonstrate the tools in action.

2 - Rams: a software for multicriteria resource allocation
João Carlos Lourenço, Centre for Management Studies of IST, Technical University of Lisbon, 1049-001 ,
Multicriteria resource allocation is a challenging problem for decision makers and analysts. A particular issue is that of the robustness of portfolios to variations in criteria weights, projects value scores and costs. In this talk we present a new software (RAMS - Resource Allocation Management System) which uses an intuitive Pareto-front display to give decision makers an overview of the optimal solutions at different levels of spend, but which also allows indepth interactive exploration and robustness checks around some attractive portfolios.

3 - Supporting the selection of infrastructure maintenance projects with robust portfolio modelling

Pekka Mäki, Systems Analysis Laboratory, Helsinki University of Technology, Otakaari 1 M, P.O. Box 1100, 2150, Espoo, Finland, pekka.mäki@hut.fi, Juuso Liesiö, Ahti Salo

In infrastructure management, annual maintenance programmes often contain dozens of projects that are selected from hundreds of candidates in view of multiple prioritization criteria. We report experiences from the wide-scale use of Robust Portfolio Modelling (RPM) in this decision problem at the Finnish Road Administration. Due to the large problem size, we develop an approximate algorithm that computes non-dominated portfolios which are then analyzed to obtain robust yet flexible decision recommendations in the presence of portfolio constraints and incomplete preference information.

4 - Applying robust portfolio modeling methodology for the management of uncertainties in forest planning

Mikko Kerttula, Joutsuu Research Unit, Finnish Forest Research Institute, P.O. BOX 68, 80101, Joutsuu, Finland, mikko.kerttula@metla.fi, Eero Mainonen, Pekka Leskinen, Harri Kilpeläinen, Antti Punkka, Ahti Salo

Although forest planning processes include numerous uncertainties, most of existing planning tools are deterministic. This neglect of uncertainties may lead to erroneous decisions and inefficient utilization of the resources. We therefore examine how the recently developed Robust Portfolio Modeling (RPM) methodology can be used in various multi-objective forest planning situations in order to use incomplete inventory data and to capture uncertainties about the planning objectives and future timber prices. We also outline development needs that arise from the requirements of forest planning.

The purpose of the paper is to review the development of real-world stochastic programming applications at the Czech Republic region during the last fifteen years. The focus is on the recent achievements and applications related to researchers of the Brno University of Technology. The applications involve blending stones for concrete production, optimum control for casting problems, scheduling for machine tool design, etc. Features, differences, and similarities of the presented models will be discussed from the both user’s and modeller’s point of view and recommendations will be included.

2 - Stochastic programming approach to energy producing system

Michal Tous, Institute of Process and Environmental Engineering, Brno University of Technology, Faculty of Mechanical Engineering, Technicka 2, 61669, Brno, Czech Republic, tousmichal@seznam.cz, Martin Pavlas, Petr Stehlík

An optimum choice of a technology for effective utilization of biomass and/or alternative fuel integrated into complex energy producing systems is subjected to economic requirements and strongly influenced by environmental constraints and targets. The key challenge was to build a stochastic programming model that allows us to find optimal decisions about the use of fuel of various types (fossil coal and renewable biomass) with respect to the different time horizons, various demands and uncertain future with respect to technology considered, and the existing equipment design.

3 - Modelling to generate alternatives in waste management facility expansion planning using simulation-optimization

Julian Scott Yeomans, OMIS, Schulich School of Business, York University, 4700 Keele Street, SSB S338, M3J 1P3, Toronto, Ontario, Canada, syeomans@schulich.yorku.ca

Environmental policy formulation can prove complicated when the system components contain stochastic uncertainty. It has been shown that it is preferable to create several good alternatives that provide different approaches to the public decision-making problems. This study shows how simulation-optimization can be used to generate multiple policy alternatives that satisfy required system criteria and are maximally different in decision space. The efficacy of this stochastic modelling-to-generate-alternatives approach is demonstrated on a waste management facility expansion planning case.
The recombining binomial tree option price calculation procedure is combined with bounding technique, applied on each level of the tree. The bounds are obtained from the solutions of discrete moment problems, where we assume that some of the moments of the random asset price are known. The method can be advantageous also in the case, where the asset price probability distribution is completely known but the option price calculation is hard, whereas the bounds can easily be obtained. Several illustrative examples will be presented.

2 - Optimal portfolio selection based on multiple value at risk

Kunikazu Yoda, Rutcor, Rutgers Center for Operations Research, Rutgers University, 640 Bartholomew Rd, 08854, Piscataway, NJ, United States, kyoda@rutcor.rutgers.edu, Andras Prekopa

A variant of Kataoka's portfolio selection model is formulated in which lower bounds are imposed on several VaR values, where the bounds are taken from a reference probability distribution. Under mild condition it is shown that if we want at least one VaR value to be equal to its lower bound then the problem is equivalent to a disjunctive LP. The numerical solution technique will be discussed and numerical examples will be presented.

3 - Programming under probabilistic constraints with uniformly distributed random variable

Olga Myndyuk, Rutcor, Rutgers Center for Operations Research, Rutgers, The State University of New Jersey, 640 Bartholomew Rd, 08854, Piscataway, NJ, United States, olgamyn@eden.rutgers.edu

We assume that in the underlying LP the vector on the right hand side has multivariate uniform distribution in a convex set. We solve the probabilistic constrained stochastic programming problem by the supporting hyperplane and the logarithmic barrier methods. The combination of these methods provides us with lower and upper bounds for the optimum values. The problem to calculate the volumes of convex polyhedra will also be discussed. Numerical results will be presented.

4 - A two stage stochastic programming model for capacity expansion planning in the automotive industry

Cormac Lucas, School of Information Systems, Computing and Mathematics, CARISMA, Uxbridge, Uxbridge, Middlesex, United Kingdom, cormac.lucas@brunel.ac.uk, Gautam Mitra, Thomas Sommer-Dittrich

A multi-period planning model for capacity expansion is considered. The model has been developed as part of a project with a German car manufacturer. The aim of the project is to determine the configuration of the pre-assemblies. Special aspects were considered to capture the operational nature of the problem. The planning problem takes into consideration uncertain demands and is formulated as a two stage stochastic program with recourse decisions. We present results of our empirical investigation and illustrate the benefit of introducing uncertainty analysis in this planning model.

1 - A decomposition approach for solving the maximal covering location problem with an m/m/1 queuing system

Hossein Taghizaddeh Kakhtki, Mathematics, Ferdowsi Univ. of Mashhad, Mashhad, Iran, 91775-1159, Mashhad, Iran, Islamic Republic Of, taghizad@math.um.ac.ir, Forough Moeen Moghadas

We consider the maximal covering location problem in an M/M/1 queuing environment, with constrained maximum allowable waiting time, as proposed by Maianov, and Serra (1998) [Probabilistic Maximal Covering Location Allocation Models for Congested Systems, Journal of Regional Science 38(3) 401-424]. We propose a new solution procedure based on decomposition of the problem into smaller knapsack subproblems. Computational results for existing test problems, as well as for randomly generated problems are presented.

2 - The fermat-weber problem in a logistic and service network

Hans Daduna, Department of Mathematics, University of Hamburg, Bundesstrasse 55, 20146, Hamburg, Germany, daduna@math.uni-hamburg.de, Vanessa Lange

We consider the Fermat-Weber problem in a dynamical environment. From a production center goods are delivered to warehouses. Trucks are loaded at the center, drive to one of the warehouses, are unloaded there, return to the central station. We take into consideration travel times, loading and unloading times, waiting delay for loading and unloading. We determine the location for the production center such that system throughput is maximized. We discuss that temporally some warehouses do not need supply from the center. Our approach combines queuing network and location theory.

3 - Location of multiple-server immobile facilities operating as m/er/m/n queues

Vladimir Marianov, Electrical Engineering, Pontificia Universidad Catolica de Chile, Vicuna Mackenna 4860, 7820436 Macul, 7820436, Santiago, Chile, marianov@ing.puc.cl

Most location models for congested facilities assume exponentially distributed service times. These formulations do not adequately represent actual service time distributions, which often have small variances. We introduce an order r Erlang distribution for the service time in multiple-server facilities. Extensive analysis is offered on the influence of the parameters of the service time and the capacity of the facilities on the performance of the system.
Real and rich vehicle routing problems
Stream: Vehicle Routing
Invited session
Chair: Giovanni Righini, D.T.I., Università degli Studi di Milano, Via Bramante 65, 26013, Crema, CR, Italy, righini@dti.unimi.it

1 - An exact algorithm for the discrete split delivery vrp with time windows

Ilaria Vacca, Transport and Mobility Laboratory (Transp-OR), École polytechnique fédérale de Lausanne (EPFL), GC B 435 (Bâtiment GC), Station 18, 1015; Lausanne, Switzerland, ilaria.vacca@epfl.ch, Matteo Salani

The Split Delivery Vehicle Routing Problem (SDVRP) is a variant version of the classical VRP in which each customer can be visited by more than one vehicle which serves a fraction of its demand. The Discrete SDVRP is another variant in which the delivery request of a customer consists of several items which cannot be split further. In this work we consider the DSDVRP with time windows where the service of items combinations imply a corresponding service time. We present a branch-and-price algorithm and discuss the implications of the classical Dantzig Wolfe reformulation.

2 - Maritime distribution of stone products

Johan Oppen, Molde University College, P O Box 2110, 6402, Molde, johan.oppen@hiMolde.no

NorStone produces 8 mill tons of stone products a year. The main products are aggregate for concrete and asphalt, railway gravel, materials for road building and for protection of underwater oil and gas pipelines. The products are based both on crushed stone from stone quarries and sand and gravel from sand pits. We present a problem description and mathematical models. We also discuss possible solution methods to handle the problem, both in terms of exact methods for small problem instances and simplified models, and heuristics to be used in a real-world planning system.

3 - A branch-and-price algorithm for the multi-depot heterogeneous fleet vehicle routing problem with time windows

Giovanni Righini, D.T.I., Università degli Studi di Milano, Via Bramante 65, 26013, Crema, CR, Italy, righini@dti.unimi.it, Andrea Bettinelli, Alberto Ceselli

We address a variation of the vehicle routing problem with time windows (VRPTW) in which the available fleet is made by vehicles with different characteristics (speed, capacity, fixed costs, . . .) and the routes can start from different depots. We present a set covering reformulation and a column generation algorithm, where the pricing subproblem is solved via bi-directional dynamic programming and decremental state space relaxation. We report on preliminary experimental results on benchmark instances from the literature.

Cutting and Packing 1
Stream: Cutting and Packing
Invited session
Chair: Horacio Yanasse, LAC, INPE, Av. dos Astronautas 1758, CP 515 - INPE/CTE, 12227-010, São José dos Campos, SP, Brazil, horacio@lac.inpe.br

1 - Exact algorithm for one-dimensional cutting stock problem with given number of setups

Xiang Song, School of Mathematics, University of Cardiff. Senghennydd Road, CF24 4AG, CARDIFF, Wales, UK, CF24 4AG, Cardiff, Wales, songx6@cardiff.ac.uk

Classical 1D cutting stock problem consists of finding a way of cutting the stock roll into the smaller ones with the minimum material wastage and meet the customer’s demand. However, in reality the total production costs associate with not only material wastage but also setup cost. An auxiliary problem is to minimize the number of different cutting patterns that are used. We aim at solving exactly a variant of 1DCSP, called pattern restricted problem to minimize the number of the stock rolls with the given number of different cutting patterns. A variant column generation technique is used.

2 - New lower bounds based on column generation and constraint programming for the pattern minimization problem

Cláudio Alves, Departamento de Produção e Sistemas, Universidade do Minho, Campus de Gualtar, 4710-057, Braga, Portugal, claudio@dps.uminho.pt, Rita Macedo, J. M. Valério de Carvalho

The Pattern Minimization Problem is a Cutting and Packing problem that consists in finding a cutting plan with the minimum number of different patterns. We explore a different Integer Programming model that can be solved using column generation, describe different strategies to strengthen it, among which are Constraint Programming and new families of valid inequalities, and derive new lower bounds. Our approaches were tested on a set of real instances, and on a set of random instances from the literature, and showed a clear improvement on the quality of the lower bounds.

3 - An integer programming formulation for the minimization of open stacks problem

Isabel Cristina Lopes, Dep. Matemática, ESEI-G - Instituto Politecnico do Porto, Rua D.Sancho I, 981, 4480-876, Vila do Conde, tulicreme@netcabo.pt, J. M. Valério de Carvalho

In cutting industries, the different items obtained from cutting patterns are piled in stacks around the machine until all items of the same size are cut. It is desirable to find a sequence of patterns that minimizes the number of different items that are being cut. This is known as the Minimization of Opens Stacks Problem (MOSP). We explore an integer programming formulation for the MOSP, by associating each instance with a graph having a vertex for each item stack and an arc if there is a pattern that produces both items.

4 - A heuristic for the problem of minimizing the number of saw machine cycles

Horacio Yanasse, LAC, INPE, Av. dos Astronautas 1758, CP 515 - INPE/CTE, 12227-010, São José dos Campos, SP, Brazil, horacio@lac.inpe.br, Rodolfo Ranck_Junior, José Carlos Beccheneri
In this work we present a heuristic and an integer linear programming model for the problem of minimizing the number of saw machine cycles. The heuristic uses the idea of generating cutting patterns that can be repeated many times in association with an approximate resolution of an integer programming model. The model is solved using column generation and a rounding method. The results of some computational experiments are presented using randomly generated instances.

### MC-17

**Monday 12:00-13:20**

**Resources in machine scheduling**

*Stream: Scheduling under Resource Constraints*

*Invited session*

**Chair:** Joanna Jozefowska, Institute of Computing Science, Poznań University of Technology, Piotrowo 2, 60-965, Poznań, Wielkopolska, Poland, jjozefowska@cs.put.poznan.pl

1. **Resource-constrained flowshop scheduling with resource recycling operations included**
   - Hsiao-Lan Huang, Institute of Information Management, National Chiao Tung University, 1001, University Road, 300, Hsinchu, Taiwan, lan0903@gmail.com, T.C. Edwin Cheng, Bertrand Lin

This paper studies a generalization of the relocation problem which is formulated from a redevelopment project into a resource-constrained project scheduling problem. In the basic relocation problem, the redevelopment of a building is treated as a single job. In this paper, we separate the demolishing process and reconstruction process, each is performed an independent crew. We formulate this setting into a resource-constrained scheduling problem in a two-machine flowshop. Optimality properties will be addressed. We also discuss the complexity status of several special cases.

2. **Exact methods for the hybrid flowshop problem with batching machines**
   - Adrien Bellanger, Ecole des mines de Nancy, LORIA - INRIA Nancy Grand Est, Ecole des mines de Nancy (INPL) - LORIA, projet ORCHIDS, Parc de Saurupt, CS 14 234, 54042, NANCY CEDEX, France, adrien.bellanger@loria.fr, Ammar Oulamara

In this paper, we study exact methods for the hybrid flowshop problem with batching machines. The first stage consists of several identical machines and the second stage consists of several batching machines. Processing time of each task is given by an interval on batching machines, and tasks of the same batch have to share a common processing time. We present two branch and bound methods to solve this problem. Direct method solves the previous problem, whereas reverse method solves the reversed problem. Several computational experiments will be presented to show the efficiency of our method.

3. **Resource allocation with apportionment methods**
   - Joanna Jozefowska, Institute of Computing Science, Poznań University of Technology, Piotrowo 2, 60-965, Poznań, Wielkopolska, Poland, jjozefowska@cs.put.poznan.pl, Wiesław Kubiak, Łukasz Jozefowski

Allocation of resources is a main task of any scheduling system. From the client point of view, fairness is one of the most important issues. This criterion is often considered in the control of IT systems where clients compete for shared resources. The most popular approaches aim at minimization of Relative Fairness Bound (RFB) and Absolute Fairness Bound (AFB). Both problems can be generalized to proportional allocation of any discrete resource. We prove that the optimization of the RFB leads to the Alabama paradox found in the apportionment theory and propose an algorithm to minimize AFB.

### MC-18

**Monday 12:00-13:20**

**Lenne**

*Modern Applications of Mathematical Programming I*

*Stream: Mathematical Programming*

*Invited session*

**Chair:** Diethard Pallaschke, Statistics and Mathematical Economics, University of Karlsruhe, Kaiserstr. 12, Geb. 11.40, D-76128, Karlsruhe, Germany, lh09@rz.uni-karlsruhe.de

**Chair:** Ryszard Urbanski, Faculty of Mathematics and Computer Science, Adam Mickiewicz University, Poznan, ul. Umultowska 87, PL-61-614, Poznan, Poland, rich@amu.edu.pl

1. **Optimization of the investments’ distribution by the stages of the joint implementation projects’ realisation**
   - Vlad Kucher, -, 04111, Kiew, commastergm@gmail.com

Some problems of joint implementation project realization (JIP) arising while investments are mobilized for such projects directed toward energy efficiency increase and GHG emissions' mitigation with respect to the Kyoto Protocol are considered. Fuzzy-set estimation introduced for JIP allows estimating investment process efficiency. Problem of investments’ distribution optimisation with respect to the project stages is solved as a problem of fuzzy mathematical programming. Problem posing supposes optimisation of investment distribution with respect to the project stages aimed in maximal NPV effect under limitations on emissions’ normalized Kyoto levels and on the budget of the investor.

2. **On stability of the mpcc feasible set**
   - Vladimir Shikhman, Dept. Mathematics, RWTH Aachen University, Templergraben 55, 52056, Aachen,
Germany, shihkman@mathc.rwth-aachen.de, Hubertus Th. Jongen, Jan-J Ruckmann

The feasible set of mathematical programs with complementarity constraints (MPC) is considered. We discuss local stability of the feasible set with respect to perturbations (up to first order) of the defining functions. Here, stability refers to homeomorphy invariance under small perturbations. For stability we propose a kind of Mangasarian-Fromovitz Condition (MFC) and its stronger version (SMPC). We elaborate some links to metric regularity, Moreau's subdifferential qualification condition and generalized Mangasarian-Fromovitz Constraint Qualification.

3 - Completeness of the Minkowski-Rådström-Hörmander space.

Hubert Przybycien, Mathematics, AM University, 61-614, Poznan, Poland, hubert@amu.edu.pl, Ryszard Urbanski, Jerzy Grzybowski

We present a proof of completeness (in metric delta-type) of the Minkowski-Rådström-Hörmander space over an abstract convex cone which is metrizable by complete and translation invariant metric.

4 - Reduction of finite exhausters

Ryszard Urbanski, Faculty of Mathematics and Computer Science, Adam Mickiewicz University, Poznan, ul. Umultowska 87, PL-61-614, Poznan, Poland, rich@amu.edu.pl, Jerzy Grzybowski, Diethard Pallaschke

We introduce the notion of shadowing sets which is a generalization of the notion of separating sets. We prove that the intersection of the family of convex sets $A_i, i=1, ..., n$ shadows the family if and only if $A_1^* + ... + A_n^*$ is equal to the Minkowski sum of the intersection of all $A_i$ and the convex hull of all sums $A_1^* + (A_i - A_i^*) + ... + A_n^*$. In terms of shadowing sets, we give a criterion for the minimality of finite upper exhausters. Finally, we give an example of two different minimal upper exhausters of the same function, which answers the question posed by V. F. Demynov.
We present a new methodology to solve the flexible shift scheduling problem of physicians. The formulation of the problem allows shifts to be generated implicitly rather than employing a predefined set of shift types. Our objective is to minimize the total cost of the assignments given the general labor restrictions. To find high quality assignments, a branch-and-price algorithm is developed that uses several branching rules. The master problem is formulated as a set covering problem whereas the subproblems are mixed integer programs.

2 - Planning elective surgeries — analysis and comparison in a real case

Inês Marques, DEIO - CIO, Faculdade de Ciências da Universidade de Lisboa, Campo Grande - Ed. C6 - 4º Piso, 1749-016, Lisbon, Portugal, ines.marques@fc.ul.pt, Maria Eugénia Captivo, Margarida Pato

This work emerges from an urgent need to rationalize resources in health care as well as to reduce waiting lists for surgery in Portugal. An integer linear programming model is presented to schedule elective surgeries. Model solutions were obtained using an exact solver. We compare a real week plane of a hospital in Lisbon with the results obtained from the application of the model developed, considering real data of the same hospital.

3 - Operational research to support the development of triage protocols for use in determining access to paediatric intensive care in the context of pandemic influenza.

Martin Utley, Clinical Operational Research Unit, University College London, Gower Street, WC1E 6BT, London, United Kingdom, m.utley@ucl.ac.uk

The threat of an influenza pandemic remains a concern within the UK. At the peak of a pandemic, there would be no access to paediatric intensive care units. However, it is anticipated that there would be periods when paediatric intensive care units are operational and demand is significantly greater than capacity. This presentation will concern analysis being conducted to support the development of protocols to determine access to and continuation of intensive care in this context.
We present the impact of introducing decision support for the large-scale crew scheduling problems arising at the Dutch railway operator, Netherlands Railways (NS). NS operates about 30,000 trains a week. These trains need a driver and a certain number of conductors, resulting in crew duties for about 6000 train crew employees. The corresponding planning process is supported by advanced Operations Research techniques. We will focus both on improvements to the planning process and in the product. We show the positive impact on efficiency, punctuality, and on job satisfaction of the train crew.

2 - How can the railway system benefit from OR tools? some preliminary observations from sncf

David De Almeida, Innovation & Research Department, SNCF, 75379, Paris CEDEX 08, France, david.de_almeida@sncf.fr

Railways undertakings and infrastructure manager must focus on customer expectations and manage their scarce resources more efficiently and in a more agile way. The railway production system relies on a heavy planning process where OR tools can be very valuable to enhance current practices, for example by the production of optimized engines circulations or through the investigation of many more production scenarios with the help of computerized OR models. However, such tools require a proper integration with the existing information systems and the end users in order to deliver their promises.

3 - Impact of or-tools at prorail network development

Dick Middelkoop, Netherlands, d.middelkoop@railned.nl

ProRail, the Dutch rail infrastructure manager, is responsible for the safe and optimal use of the rail network. To ensure this we try to look into the future to determine how to solve potential bottlenecks in the network given the demand forecast. This toolbox has a number of tools that support activities in the field of passenger and freight forecasts, optimisation of train services, timetable design and simulation, capacity analysis and traffic management systems. With this toolbox ProRail improves the quality and the throughput times of the network design and the decision making process.

A new approach to prioritize project portfolio in an efficient and reliable way is presented. It introduces a rigorous procedure, based on ANP and the strategic objectives of the company, with acceptable complexity which seeks to assist managers of a big Electrical Company of Venezuela to distribute the annual budget among the possible improvement actions to be conducted on the electrical network of Caracas. A total of 15 network improvement actions grouped into three clusters according to the strategic objectives of the company have been analyzed using the Project Strategic Index proposed.

2 - Location of a municipal solid waste management plant in the metropolitan area of valencia (spain) using an analytic network process model.

Pablo Aragones-Beltran, Engineering Projects, Universidad Politecnica de Valencia, Camino de Vera s/n, 46022, VALENCIA, VALENCIA, Spain, aragones@dpi.upv.es, Juan P. Pastor-Ferrando, Fernando Garcia-Garcia, Amadeo Pascual-Agulló

In this work ANP is applied to select the best location for the construction of a municipal solid waste (MSW) plant in the Metropolitan area of Valencia (Spain). This is a complex multicriteria decision-making problem that requires an extensive evaluation process of the potential MSW plant locations and other economic, technical, legal, social or environmental issues. The decision-making process includes the identification of six candidate MSW plant sites and 21 criteria grouped into clusters. The influences between the elements of the network were identified and analyzed using the ANP.

3 - Comparison of two apparel retailer companies: a multiple criteria evaluation of retail locations

Y. Ilker Topcu, Industrial Engineering, Istanbul Technical University, Istanbul Teknik Universitesi, Isletme Fakultesi, Macka, 34367, Istanbul, Turkey, ilker.topcu@itu.edu.tr, Sebnem Burnaz

This study proposes an ANP based evaluation of retail locations by using the judgments of professionals from two retailer companies operating mainly in apparel sector: a major global retailer with over 840 stores in more than 30 countries around the world versus a local industry-leading retail store chain with more than 200 stores in 50 cities of Turkey. As a result of the process; the retail location evaluation criteria were identified, the relations among the criteria were assessed, and the relative importance of the criteria with respect to two companies was revealed.

Projects prioritization in higher education institutions using the analytic network process

Nina Begicicvic, University of Zagreb, Faculty of Organization and Informatics, 99999, Varazdin, Croatia, begicicvic@foi.hr, Blazenko Divjak, Tihomir Hunjak

In this paper we deal with prioritization of projects in higher education institutions. The first scenario is a need to prepare an action plan for activities that will result in the implementation of a portfolio of projects at the institutional level. The second scenario is making a decision on whether to start a new project application in a situation where project teams have several project ideas and limited resources. The purpose of the paper is to show how to include corporate strategy in the decision-making process and use the Analytic Network Process in solving project selection problems.
the important class of lower semicontinuous convex functions. and study the main properties of this class of functions containing
tions with evenly convex epigraphs, the evenly convex functions,
in the eighties, it was started to use evenly convex sets in quasicon-
order to extend the polarity theory to nonclosed convex sets. In
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The report is devoted to the study of a class of DC problems
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stream of hierarchical optimization
bilevel finite and infinite programs with convex data on both lower
and upper levels of hierarchical optimization

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In 2005, Laurence and Wang introduced two linear SIPs for lower
and upper bounds on the prices of basket options. Although the
upper bound problem has an analytic solution, the lower bound
problem needs numerical solution. In this talk we investigate the
performance of a discretization method (with a DC algorithm for
the inner global optimization problem) and compare it to the ex-
act solution derived by an ordinary LP. Based on these observations
we highlight a surprising strong dependence of the performance on
a discriminant parameter, which will be interpreted in a financial
context.

2 - Qualification, optimality conditions, and subdiffer-
entials of optimal values functions for dc infinite and
semi-infinite programs

Dinh Nguyen, Department of Mathematics,
International University - VNUHCM, Hochiminh city,
Vietnam, Quarter 6, Linh Trung ward, Thu Duc
district. Ho Chi Minh city, 84, Ho Chi Minh,
ndinh@hcmiu.edu.vn

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with infinitely many convex inequality constraints in locally convex
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necessary and sufficient optimality conditions for such a class of
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1 - Bounds on basket options by linear semi-infinite
programming

Ralf Werner, Risk Methodology, Hypo Real Estate /
TU München, Unsöldstr. 2, 80538, München,
Germany, werner_ralf@gmx.net

In 2005, Laurence and Wang introduced two linear SIPs for lower
and upper bounds on the prices of basket options. Although the
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with infinitely many convex inequality constraints in locally convex
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3 - Evenly convex functions

Margarita Rodríguez Álvarez, Dpto. Estadística e
Investigación Operativa, Universidad de Alicante, Ctra.
Alicante-San Vicente s/n, 03690, San Vicente del
Raspeig, Alicante, Spain, marga.rodriguez@ua.es, José
Vicente Pérez

A set is evenly convex if it is the intersection of some family of open
halfspaces. This class of convex sets was introduced by Fenchel in
order to extend the polarity theory to nonclosed convex sets. In

the eighties, it was started to use evenly convex sets in quasicon-

vex programming dening the evenly quasi-convex functions as those
having evenly convex sublevel sets. In this work, we consider func-
tions with evenly convex epigraphs, the evenly convex functions,
and study the main properties of this class of functions containing
the important class of lower semicontinuous convex functions.
1 - Adding edges to multi-levels of a complete k-ary tree minimizing total distance

Kiyoshi Sawada, Department of Information and Management Science, University of Marketing and Distribution Sciences, 3-1, Gakuen-nishi-machi, Nishi-ku, 651-2188, Kobe, Kiyoshi_Sawada@red.umds.ac.jp

This study proposes a model of adding relations in multi-levels to an organization structure which is a complete K-ary tree such that the communication of information between every member in the organization becomes the most efficient. When edges between every pair of nodes at each of L levels are added to a complete K-ary tree of height H, an optimal set of depths of L levels is obtained by minimizing the total distance which is the sum of the number of edges in shortest paths between every pair of all nodes in the complete K-ary tree.

2 - Finding Hamiltonian contour with minimal acceptable risk weight

Mirko Vujosevic, Laboratory for Operational Research, Faculty of Organizational Sciences, Jove Ilica 154, 11000, Belgrade, Serbia, mirkov@fon.rs, Djokovic Aleksandar

The weight of the Hamiltonian contour (Hc) is supposed to be normally distributed random variable with mean and variance calculated as the sums of the corresponding means and variances of its edges. The Hc weight of the acceptable risk is defined as the value for which the probability of realization of weights greater than this value is less than given risk probability. The problem is to find Hc with the minimal acceptable risk weight for given risk probability. An algorithm for its solving and some preliminary results are presented.

3 - Mathematical modeling and solving the metric dimension and related problems

Mirjana Cangalovic, Department of Mathematics, Statistics and Operational Research, Faculty of Organizational Sciences, University of Belgrade, Jove Ilica 154, Belgrade, Serbia, Serbia, canga@fon.rs, Jozef Kratica, Vera Kovacevic Vujcic

The paper considers three NP-hard optimization problems on graphs: the metric dimension, the strong metric dimension and the minimal doubly resolving set problems. We present the corresponding integer linear programming models. Numerical experiments are performed on several classes of graphs, including hypergraphs and Hamming graphs, as well as on crew scheduling and graph coloring ORLIB instances. Problems of smaller dimensions are solved exactly, while large scale problems are treated by genetic algorithms.

4 - A greedy algorithm for obtaining global information from local informations in a Markov network

Edith Kovacs, Department of Mathematics, Budapest College of Management, Villanyi ut 11-13, 1114, Budapest, Hungary, edith_kovacs@yahoo.com, Tamas Szantai

In order to approximate a joint probability distribution we have introduced a special kind of junction tree, called t-cherry junction tree in our earlier work. This approach is based on the t-cherry tree and t-hypercherry tree. We developed a greedy algorithm that can derive from the local information contents an optimal t-cherry junction tree (a special spanning hypertree) which encodes the information of the joint probability distribution. In the last part we highlight some possible applications of our theory in data mining problems such as classification and pattern recognition.
We consider a container terminal where vessels arrive randomly within an arrival window given by a fixed periodic schedule. Vessel processing requires an assignment of quay cranes and berth sections, and is required to be completed within a contractually agreed service time. This can be formulated as a stochastic dynamic resource allocation problem. A Markov decision process model is proposed, and algorithms for derivation of its optimal control policy are given for different cost criteria. The resulting closed-loop system is analyzed with respect to robustness for non-modeled disturbances.

### MC-28
**Monday 12:00-13:20**
**GSI - S 1**

#### Financial Optimization 2
**Stream: Financial Optimization**

**Invited session**
- **Chair:** Diana Barro, Dept. of Applied Mathematics, University of Venice, Dorsoduro 3825/E, 30123, Venezia, Italy, d.barro@unive.it

**1 - Skewness-aware asset allocation: empirical evidence**
  - Dessislava Pachamanova, Mathematics and Sciences, Babson College, 319 Babson Hall, 02457, Babson Park, MA, United States, dpachamanova@babson.edu, Melvyn Sim, Cheekiit Low

We introduce a measure of portfolio skewness that can be linked to tail risk measures such as Value-at-Risk, and generalize the idea of variance and covariance in the new skewness-aware asset pricing and allocation framework. We show via computational experiments that the proposed approach results in improved and intuitively appealing asset allocation when returns follow real-world or simulated skewed distributions. We also suggest a skewness-aware equivalent of the classical CAPM beta, and study its consistency with the observed behavior of the stocks traded at the NYSE between 1963 and 2006.

**2 - Stochastic portfolio optimization with market frictions**
  - Miguel Lejeune, Decision Sciences, George Washington University, 2201 G Street, NW, 20052, Washington, DC, mljeune@gwu.edu

We propose probabilistic asset allocation models that account for market frictions and for the estimation risk pertaining to asset returns. Exact solution methods are developed and their computational results are compared. The application of the model and solution approach for the construction of funds traded on major market indexes are given for different cost criteria. The resulting closed-loop system is analyzed with respect to robustness for non-modeled disturbances.

**3 - Application of interactive surrogate constraint method to financial optimization problems**
  - Yuji Nakagawa, Faculty of Informatics, Kansai University, 2-1-1 Ryouzenji-Chō Takatsuki-City, 569-1095, Osaka, Japan, nakagawa@res.kutc.kansai-u.ac.jp, Yuirko Isada, Nobuko Igaki, Chanaka Edirisinghe

Large-scale separable nonlinear integer programming problems with multiple constraints can be solved optimally by using the improved surrogate constraints (ISC) method. We developed an interactive optimization solver based on the ISC method to solve a non-separable and non-convex optimization problem. The interactive optimization solver is applied to the financial optimization problems, e.g., mean-variance model and the index-plus-alpha-funds optimization model. The models are applied to the Tokyo Stock Market and computational results are reported.

**4 - The effect of shorting in optimal tracking error portfolios**
  - Diana Barro, Dept. of Applied Mathematics, University of Venice, Dorsoduro 3825/E, 30123, Venezia, Italy, d.barro@unive.it, Gautam Mitra, Diana Roman

In this paper we analyze the effect of using long short portfolio to track an index. The main objectives of this contribution are to point out the effect of shorting mainly in a bearish market and to analyze the effect of shorting both in a symmetric and asymmetric tracking error cases in presence of extreme event scenarios. We are interested in analyzing the increased flexibility in the tracking strategies granted by the introduction of short selling in terms of tracking performance in normal market conditions and in presence of extreme events.

### MC-29
**Monday 12:00-13:20**
**GSI - S 2**

#### Risk and Uncertainty in Energy Models
**Stream: Energy and Emission Markets**

**Invited session**
- **Chair:** Christoph Weber, Universität Essen, Universitätsstr. 11, 45117, Essen, Germany, Christoph_Weber@uni-duisburg-essen.de
- **Chair:** Dominik Möst, Universität Karlsruhe, Institut für Industrial Production (IIP), Hertzstraße 16, 76131, Karlsruhe, Germany, Dominik.Moest@kit.edu

**1 - Power plant dispatch and portfolio management under uncertain fuel and electricity prices**
  - Dominik Möst, Universität Karlsruhe, Institut für Industrial Production (IIP), Hertzstraße 16, 76131, Karlsruhe, Germany, Dominik.Moest@kit.edu, Dogan Keles, Wolf Fichtner

In liberalised energy markets energy utilities are facing several uncertainties. The short-term plant dispatch is mainly affected by uncertain fuel and electricity prices. In this contribution these uncertainties are modelled with time series models such as ARMA-processes. The simulated price paths are used in a stochastic model based on a recombining tree approach, to optimize the plant dispatch and the electricity trade on the wholesale market. Results of the stochastic model are compared with a deterministic calculation, to point out the impact of stochastic parameters.

**2 - Advantages of a stochastic optimization in mid-term generation and trading planning**
  - Bernd Tersteegen, Institute of Power Systems and Power Economics (RWTH Aachen University), Schinkelstr. 6, 52056, Aachen, bt@iaew.rwth-aachen.de, Tobias Mirbach, Gerd Hinueber

Within the scope of this work a stochastic optimization method for power generation and trading planning is presented. The investigations focus on the influence of price uncertainties for unit commitment of thermal power plants under consideration of fuel constraints. In particular, the difference between a deterministic Monte Carlo simulation and a stochastic optimization by means of scenario analysis using scenario trees will be investigated with respect to a robust optimization result. Therefore, the scheduling of power plants as well as the contribution margin will be analyzed.
3 - Valuation of a flexible gas fired unit under uncertain prices
Marc Hasenbeck, F&E, priceit GmbH, Breite Str. 32a, 06108, Halle, Sachsen-Anhalt, hasenbeck@price-it.eu

We present a modelling approach for a flexible gas fired unit for the purpose of valuation and controlling facing uncertainty in prices for gas and electricity. Especially it is taken care of a realistic modelling of prices and the embedding of important restrictions like minimum uptimes and downtimes, ramp up costs and lead times for commitment decision. The path-dependent problem is solved with Stochastic Dynamic Programming in a Quasi-Monte-Carlo environment. Finally we discuss the value of flexibility as part of real options theory and hedging strategies.

■ MC-30
Monday 12:00-13:20
GSI - S 26
Dynamic Programming I
Invited session
Chair: Lidija Zadnik Stirn, Biotechnical Faculty, University of Ljubljana, Vecna pot 83, 1000, Ljubljana, Slovenia, Lidija.zadnik@bf.uni-lj.si

1 - The dynamic lot size problem with minimum order quantities and capacity constraints
Irena Okhrin, Juniorprofessur in Information & Operations Management, European University Viadrina, Grosse Scharrnstrasse 59, 15230, Frankfurt (Oder), Germany, irena.okhrin@euv-frankfurt-o.de, Knut Richter

The paper continues the analysis of a capacitated single item lot sizing problem where a minimum order quantity restriction, instead of the setup cost, guarantees a certain level of production lots. We work out the necessary and sufficient solvability conditions and apply the dynamic programming technique to develop a solution algorithm that is based on the concept of minimal sub-problems. An investigation of the properties of the optimal solution structure allowed us to reduce the complexity of the algorithm. Computational tests confirm the efficiency of the solution algorithm developed here.

2 - Multi-level hierarchic Markov process as a tool for optimization of beef heifer management decisions
Anna Stygar, Department of Cattle Breeding, University of Agriculture in Krakow, al. Mickiewicza 2/428, 30-059, Krakow, rwi@wp.pl, Anders Kristensen

Economic efficiency of beef herd is highly influenced by the decisions on heifer management. The identification of the optimal decisions can be supported by means of mathematical modeling and programming. The objective of this study was to develop the model to optimize the strategy of beef heifer rearing and mating concerning economic output at single-animal level. Optimization was performed using dynamic programming method with multi-level hierarchic Markov approach. The model was created as a plug-in of MLHMMP software.

3 - A unifying approximate dynamic programming model for the economic lot scheduling problem
Christiane Barz, Booth School of Business, University of Chicago, 5807 S Woodlawn Ave, 606037, Chicago, Illinois, United States, cbarz@chicagoGSB.edu, Dan Adelman

We formulate the economic lot scheduling problem with sequence-dependent setups as a semi-MDP. An affine approximation of the bias function gives a semi-infinite LP determining a lower bound for the minimum average cost rate. Under a mild condition, we can reduce this problem to a small convex quadratically constrained linear problem, which is equivalent to the lower bound problems derived by Dobson (1992) and Bomberger (1966). We thus provide a framework that unifies previous work, and opens new paths for future research on tighter lower bounds and dynamic heuristics.

■ MC-31
Monday 12:00-13:20
GSI - S 34
Data Mining Applications in Quality Improvement
Invited session
Chair: Gulser Koksal, Industrial Engineering, Middle East Technical University, 6531, Ankara, Turkey, koksal@ie.metu.edu.tr

1 - Exploring the emotions of internet newspaper reader’s by kansei engineering
Ezgi Aktar Demirtas, Industrial Engineering, Eskişehir Osmangazi University, Eskişehir Osmangazi University Department of IE, 26140 Meselik ESKISEHIR/TURKIYE, 26140, ESKISEHIR, Turkey, eaktar@ogu.edu.tr, Berna Ulutas

By the development of internet applications and changes in the reader’s habits, internet newspapers are becoming more popular in these days. This study proposes a Kansei Engineering approach to explore the emotions of internet newspaper readers. A group of representative readers have been asked to evaluate different newspaper designs by using a semantic differential scale for the kansei words that specific to internet newspapers. Then, the kansei words that can influence reader’s preferences are investigated by Ordinal Logistic Regression which is superior to traditional methods.

2 - Comparison of data mining algorithms for classification and prediction in quality improvement
Gulser Koksal, Industrial Engineering, Middle East Technical University, 6531, Ankara, Turkey, koksal@ie.metu.edu.tr, Zeynep Anakli, Inci Batmaz,
In this paper, we construct a permit market model to derive a pricing formula of contingent claims traded in the market in a general equilibrium framework. It is shown that prices of contingent claims exhibit significantly different properties from those in the ordinary financial markets. In particular, if the social cost function kinks at some level of abatement, the forward price as well as the spot price can be subject to the so-called price spike. However, this price-spike phenomenon can be weakened if the system of banking and borrowing is properly introduced.

2 - On lazy $\sigma$-game and its behavior

Jun Kiniwa, Applied Economics, University of Hyogo, 8-2-1 Gakuen nishi-machi, 651-2197, Kobe, Hyogo, Japan, kiniwa@econ.u-hyogo.ac.jp, Takeshi Koide, Hiroaki Sandoh

To increase the market similarity of a minority game, a $\sigma$-game was presented. However, since it is defined as an offline game, it is difficult to simulate it. We propose a new online version of the $\sigma$-game, called a lazy $\sigma$-game. First we reveal the condition of a bubble phenomenon in the lazy $\sigma$-game. Next we investigate the price behavior in the lazy $\sigma$-game and show that there are some upper/lower bounds of price as long as both buyers and sellers are nonempty. Then we consider the similarity between the lazy $\sigma$-game and the $\sigma$-game. Finally we present simulation results.

3 - An investor/entrepreneur dynamic model of start-up firms

Edgar Possani, Department of Mathematics, Instituto Tecnologico Autonomo de Mexico, Rio Hondo No.1, Col. Progreso Tizapan, C.P. 61080, Mexico City, D.F. - Mexico, Mexico, epossani@itam.mx, Thomas Archibald, Lyn Thomas

Start-up firms are important drivers of modern economies, not only as a source of innovation but also in the generation of new jobs. We examine how different objectives for investors and entrepreneurs affect the characteristics of the investment contracts and operating policies used by start-up firms. Using Markov decision models we address financial and operating decision under different economic environments, and give conditions under which optimal policies change for both parties.

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**MC-32**

**Monday 12:00-13:20**

**GSI - S 4**

**Financial Markets**

Stream: Financial Modelling

**Contributed session**

Chair: Gabriela Fernández Barberis, Métodos Cuantitativos para Economía, Universidad San Pablo-CUE, Fac. CC. Económicas y Empresariales, Julián Romea 23, 28003, Madrid, Madrid, Spain, ferbar@ceu.es

1 - Equilibrium pricing of contingent claims in tradable permit markets

Katsumasa Nishide, Interdisciplinary Research Center, Yokohama National University, 79-3 Tokiwadai, Hodogaya-ku, 2408501, Yokohama, Japan, knishide@ynu.ac.jp

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**MC-33**

**Monday 12:00-13:20**

**GSI - S 7**

**global optimization in locating in space**

Stream: Global Optimization

**Invited session**

Chair: Oleg Burdakov, Department of Mathematics, Linkoping University, Campus Valla, 58183, Linkoping, Sweden, olbur@mai.liu.se

1 - Nash equilibria in locational analysis

Elena Saiz, Strategy, Radboud Universiteit Nijmegen, Thomas van Aquinostraat 3.1.04, 6525GD, Nijmegen, Netherlands, e.saiz@fm.ru.nl, Eligius M.T. Hendrix, Blas Pelegrin

The location decision of a facility for two competing chains in a new planar market is described by a Huff-like attraction model. This means that the market share capture is given by a gravity model. The profit that can be reached depends on the actions of the competitor. The main question is what are the possible Nash equilibria in such a situation, how are they characterised and by which computational methods could they be determined.
2 - Competitive facility location and design model with reaction of competitors in the plane
Saidani Nasreddine, ICD, CNRS 2848 Université de Technologie de Troyes, France, 12, rue Marie Curie - BP 2060, 10010, TROYES, France, nasreddine.saidani@utt.fr, Chu Feng, Chen Haoxun
This work investigates the location and design of a single new facility in a competitive market. The demand is split probabilistically over all facilities proportionally to the attraction of each facility. The attraction is determined by a gravitational type model. We develop a new technique with two stages by combining the techniques of operations research and those of game theory. We use the global optimization to determine the location that maximizes the profit and the Nash equilibrium to determine the quality of the new facility and those in the market that guarantee the equilibrium.

3 - Optimal placement of communications relay nodes
Oleg Burdakov, Department of Mathematics, Linköping University, Campus Valla, 58183, Linköping, Sweden, olbur@mai.liu.se, Patrick Doherty, Kai Holmberg, Per-Magnus Olsson
We consider optimal 3D placement of communications relay nodes (unmanned vehicles, UVs) in the presence of obstacles. It is a difficult multi-extremal problem with typically disjoint feasible set. A spatial discretization and a reduction to a shortest path problem allows efficient finding a good approximation to a global minimum. Restricted number of available UVs is also considered. We introduce two label correcting algorithms for the hop-restricted shortest path problem. The algorithms produce a Pareto solution to the two-objective problem of minimizing the path cost and the number of hops.

4 - On the convex hull of huffman codes
Thanh Hai Nguyen, Computer Fundamental Laboratory of Marseille, University of the Mediterranean sea, Faculte des Sciences de Luminy, 163, av. de Luminy, F-13288, Marseille cedex 9, France, thanh.hai.nguyen@lif.univ-mrs.fr, Jean François Maurras, Viet Hung Nguyen
In this paper, we give a partial description of convex hull of Huffman codes. That is defined from a finite set of rooted binary tree of n leaves, there are Huffman trees of n characters. To each of possible Huffman codes, which are built following the frequency distribution of each character on the text, we associate a point in Qn with constructions a partially ordered set P and a fuzzy set such that the coefficients of one of these families form a Fibonacci sequence.

1 - The use of interval valued probability measures in fuzzy linear programming
Phantipa Thipwiwatpotjana, University of Colorado Denver, 80202, Denver, United States, phantipa.thip@ucdenver.edu, Weldon Lodwick
This paper uses a constraint set approach to linear programming problems with equality constraints whose coefficients and/or right-hand side values could be uncertain. We consider three types of uncertainty: probabilistic, fuzzy/possibilistic and interval. The constraint set is ill-defined and difficult to generate. Our approach computes an inner constraint set and an outer constraint set. Optimization is then carried out using these two sets using interval valued probability approaches. We discuss the requisite associated semantics.
Co-Author: Phantipa Thipwiwatpotjana

2 - Production and transportation planning — a fuzzy approach for minimizing the total cost
Heinrich Rommelfanger, Economics and Business Administration, Goethe University, Niebergallweg 16, 65824, Schwabach a. Ts., Hessen, Germany, Rommelfanger@wiwi.uni-frankfurt.de
The target of this paper is to determine a production and transportation plan that minimize the total cost of a manufacturer that has production facilities and central stores in several sites in Europe. For working in a realistic environment we assume that the production capacities and the demand in the sales bases are not known exactly but can be described in form of fuzzy numbers. We demonstrate that this problem can adequately be solved without using computationally intensive integer programming algorithms. An numerical example illustrates the efficiency of the proposed inter-active procedure.

3 - Construction of a poset using families of strong cuts
Dragan Stojic, Quantitative methods in Economics, Faculty of Economics, Dr Sime Milesevica 16, 21000, Novi Sad, Serbia, stojicd@eccf.su.ac.yu, Dragan Vugdelija
Fuzzy sets in this paper are viewed in the most generalized setting, as mappings from a non empty set X to a poset. In the investigation of fuzzy structures, collection of cut sets are one of the most important tools. Fuzzy sets are mappings generalizing the characteristic function and also they can be characterized by collections of crisp subsets of the domain-cut sets. We present two algorithms on constructing a partially ordered set P and a fuzzy set µ such that the family of strong cuts of µ coincide with a given family of finite sets, F.
Enterprise Resource Planning systems may overwhelm managers with data to such an extent that it becomes difficult to structure information and improve operations. Group model building integrates system data and participant knowledge and is used to jointly identify improvements in work processes. We describe three group model building projects in ERP contexts, addressing effects in terms of end products, quality of solutions, results as judged by the clients (including commitment and implementation) and outcomes of system changes.

2 - Improving team effectiveness in strategic workshops: developing question sets to enhance the facilitators understanding of group dynamics in a live workshop environment.

Ashley Carreras, Leicester Business School, De Montfort University, Marketing, The Gateway, LE19BH, Leicester, United Kingdom, acarreras@dmu.ac.uk

This presentation will examine the authors use of a process of question set development to improve the facilitators understanding of the impact of group dynamics during strategy workshops. Based upon a series of workshops, where this process has been refined, the authors create a series of workshop specific questionnaires that are monitored during the event to improve the team effectiveness dimension of a workshop. The monitoring process allows the facilitators to gain an immediate understanding of the concerns of the individuals during the workshop rather than relying on post event analysis.

3 - Facilitated modelling in operational research

Gilberto Montibeller, Dept. of Management (OR Group), London School of Economics, Houghton Street, WC2A 2AE, London, United Kingdom, g.montibeller@lse.ac.uk, L. Alberto Franco

This paper discusses a particular mode of operational research intervention: facilitated modelling. Drawing on research scattered across a range of publications and domains, the review presented here provides a formal definition of facilitated modelling, together with a general framework that allows the conceptualisation of a wide variety of facilitated modelling approaches to organisational intervention. Design issues in facilitated modelling and their practical implication are discussed, and directions for future research identified.

MC-36
Monday 12:00-13:20
GSI - S 11
Stochastic Control in Insurance
Stream: Optimal Control in Finance and Insurance
Invited session
Chair: Nicole Baeuerle, Institute for Mathematical Stochastics, University of Karlsruhe, Englerstr. 2, 76128, Karlsruhe, Germany, baeuerle@stoch.uni-karlsruhe.de

1 - Compactness of the space of non-randomized policies in countable-state sequential decision processes
Eugene Feinberg, Department of Applied Mathematics, Stony Brook University, and Statistics, 11794-3600, Stony Brook, NY, United States, eugene.feinberg@sunysb.edu

For sequential decision processes with countable state spaces and compact action spaces, we prove compactness of the set of strategic measures corresponding to nonrandomized policies. It is known that for the Borel state case this set may not be compact in spite of compactness of the set of all strategic measures. We use the compactness result from this paper to show the existence of optimal policies for countable-state constrained optimization of expected discounted and nonpositive rewards, when the optimality is considered within the class of nonrandomized policies.

2 - Optimal control and dependence modeling of portfolios with lévy dynamics
Anja Blatter, Institute for Stochastics, University of Karlsruhe (TH), Kaiserstraße 89, 76133, Karlsruhe, blatter@stoch.uni-karlsruhe.de, Nicole Baeuerle

We are interested in optimizing proportional reinsurance policies in a multidimensional lévy-driven insurance model. A special feature of our construction is to allow for dependent claim occurrences in different business lines modeling dependence via an Archimedean Lévy copula. Solving the HJB equation yields that the optimal retention level keeps a constant amount of claims. Based on this we identify structure conditions with respect to the Archimedean Lévy copula under which an insurance company reinsures a larger fraction of claims from one business line than from another.

3 - On dividends charged by transaction costs in the compound Poisson risk model
Stefan Thonhauser, Institut de sciences actuarielles (ISA), University of Lausanne, Université de Lausanne Quartier UNIL-Dorigny, Bâtiment Extranef, 1015, Lausanne, stefan.thonhauser@unil.ch

We consider the compound Poisson risk model extended by the possibility of dividend payments (charged by both fixed and proportional transaction costs). The performance of an admissible dividend strategy is measured by its total expected discounted utility. We characterize the value function of the related optimization problem as a fixed point to a certain optimal stopping operator and as a solution to the associated quasi-variational inequalities. We will present a numerical method for solving the problem in general and some special cases which admit an explicit solution.

MC-37
Monday 12:00-13:20
GSI - S 12
Innovative Models in Revenue Management
Stream: Revenue Management
Invited session
Chair: Joern Meissner, Dept of Management Science, Lancaster University Management School, Room A48, LA14YX, Lancaster, United Kingdom, j.meissner@lancaster.ac.uk

1 - Risk considerations in revenue management
Matthias Koenig, Department of Management Science, Lancaster University Management School, LA1 4YX, Lancaster, United Kingdom, m.koenig@lancaster.ac.uk, Joern Meissner

Risk consideration has become an important issue in revenue management. We present current approaches how to deal with risk in dynamic pricing and dynamic capacity control. We analyze the effect of different policies regarding downside risk and volatility.
2 - Incorporating competition in dynamic pricing models

Christine Currie, School of Mathematics, University of Southampton, Highfield, SO17 1BJ, Southampton, United Kingdom, christine.currie@soton.ac.uk

Competition has been acknowledged as being an important missing element in dynamic pricing models but has received relatively little attention in the literature. We will focus on price competition in this talk and make the assumption that all of the products on sale are identical and perish on the same day. An analytical model will be used to characterise the optimal prices for the different players in the market. The effects of varying the number of competitors and the amount of inventory available in the market on the optimal prices will also be examined using a simulation model.

3 - Strategic business planning and its evaluation

Tsutomu Mishina, Systems Science and Technology, Akita Perfectural University, 84-4 Tsuchia-Ebinokuchi, 015-0055, Akita, Japan, mishina@akita-pu.ac.jp, Alejandra Gomez_Padilla

Any business plan should be fairly evaluated soon after its operation. However, unlike an evaluation based on the exact number of sales such as car sales, an effective performance-based evaluation for its general accomplishment is difficult to pursue due to its qualitative data and unclear set of goals. This paper presents a planning-evaluation method which constructs a tree of multiple purpose levels of operations. Looking from the lower levels up towards the higher levels shows the ultimate goal of the plan. An example provided shows government policy making and its evaluation.

4 - Choice-based network revenue management under weak market segmentation

Arne Karsten Strauss, Management Science, Lancaster University Management School, Lancaster, LA1 4YX, Lancaster, United Kingdom, a.strauss@lancaster.ac.uk, Joern Meissner

We present a network revenue management method where customers choose according to the MNL choice model. Weak market segmentation is reflected by allowing the sets of considered products of the different customer segments to overlap. We replace the value function of the intractable dynamic program by a time- and inventory-sensitive approximation and compute the latter via solving a large-scale linear program. We employ column generation and propose heuristics for the NP-hard subproblems. Numerical results indicate improved policy performance in particular under weak market segmentation.

5 - Topology optimization of mechanical structures subject to stress constraints

Wolfgang Achtziger, Department of Mathematics, Technische Universität Dortmund, Vogelpothsweg 87, 44221, Dortmund, Germany, wolfgang.achtziger@tu-dortmund.de, Tim Hoheisel, Christian Kanzow

Topology optimization became a promising approach to design optimization of mechanical structures. A challenge is the correct formulation and treatment of local stress constraints. Discontinuous stresses can be avoided by mixed formulations in design and state variables. The price is the violation of constraint qualifications and the failure of standard optimization methods. These problem formulations belong to the class of “Mathematical Programs with Vanishing Constraints”. As a cure some perturbation techniques have been proposed. We compare these techniques in view of topology problems.

6 - On some new aspects of the implicit programming approach in a class of mathematical programs with equilibrium constraints

Michal Cervinka, MTR, UTIA AV CR., Pod Vodarenskou vezi 4, 19208, Prague, Czech Republic, cervinka@utiia.cas.cz, Jiri Outrata

We analyze the influence of implicit programming hypothesis and presence of state constraints on first order optimality conditions to mathematical programs with equilibrium constraints. In absence of state constraints, we derive strong stationarity conditions provided the failure of standard optimization methods. Discontinuous stresses can be avoided by mixed formulations in design and state variables. The price is the violation of constraint qualifications and the failure of standard optimization methods. These problem formulations belong to the class of “Mathematical Programs with Vanishing Constraints”. As a cure some perturbation techniques have been proposed. We compare these techniques in view of topology problems.
2 - On the ordinal equivalence of values in cooperative games
Josep Freixas, Applied Mathematics 3, Technical University of Catalunya, Av. Bases de Manresa, 61-73, E-08242 MANRESA. Spain, 08242, Manresa, Spain, josep.freixas@upc.edu, Montserrat Pons

We consider the ordinal equivalence of the Shapley and Banzhaf values for transferable utility cooperative games with a fixed set of players, i.e., cooperative games for which the preorderings on the set of players induced by these two values coincide. To this end we consider several solution concepts within semivalues and introduce three subclasses of games. A characterization theorem in terms of the ordinal equivalence of some semivalues is given. For each of these classes of cooperative games we extend the proposed problem to other values.

3 - Between the prekernel and the prenucleolus
Ilya Katsev, St. Petersburg Institute for Economics and Mathematics, Russian Academy of Sciences, Tchaikovsky st. 1, 191187 St. Petersburg, Russia, 195067, Saint-Petersburg, Russian Federation, katsev@yandex.ru, Elena Yanovskaya

A collection of TU games solutions intermediate between the prekernel and the prenucleolus is considered. All these solutions are Davis-Maschler consistent, symmetric and covariant. Each solution from the collection is parameterized by a positive integer k such that for all games with the number of players not more than k the solution for parameter k coincides with the prenucleolus, and for games with more than k players it is maximal, i.e., it satisfies the “k-converse consistency”. The properties of solutions are described and their characterization by balancedness is given.

2 - Greek regional development: examining the convergence hypothesis and identifying development patterns through multivariate approaches.
Yorgos Goletis, Dept. of Economics, University of Ioannina, University campus, GR 45110, Ioannina, Greece, goletis@cc.uoi.gr, Michael Chletos

Although several studies indicate that there is evidence for EU convergence in country level this is not always true at regional level. In this work, we propose an methodology to analyse regional disparities and regional development patterns. Our methodology is composed of the development of a composite matrix aiming at capturing multiple dimensions of development and cluster analysis for the identification of development patterns. Factor analysis is applied for building the composite index and for the clustering. The methodology is applied to the case of the Greek regions.

3 - Exploring the relationship between public space intervention and homicides in bogota: case study
Juan Camilo Bohórquez, Industrial Engineering, Universidad de Los Andes, Calle 19 A & 37 Este Edificio ML, Oficina 333, 57-1, Bogota, Colombia, jua-boho@uniandes.edu.co, Juan Pablo Calderon, Olga Lucia Sarmiento, Roberto Zarama Urdenata

The CICLOVIA program in Bogotá, Colombia is a weekly program where more than 121 km of main roads are closed to cars and open to the non-motorized vehicles and recreation. The system has evolved as a network of parks and resources. This network has joined the city and transformed the dynamics of Sunday mornings from 7 am to 2 pm. As part of a broader study by CEIBA-COMPLEXITY we study the relationship between the CICLOVIA as a complex-social-system and the rate and distribution of homicides from 1977 to 2004.

4 - The evolution of the ciclovia as an adaptive network.
Juan Pablo Calderón, Industrial Engineering, Universidad de Los Andes, 57, Bogota, Colombia, ju-cal1@uniandes.edu.co, Juan Camilo Bohórquez, Olga Lucia Sarmiento, Roberto Zarama Urdenata

CICLOVIA is a weekly event that takes place in Bogotá, Colombia. It holds approximately one million people per week in 121 kilometers of roads being open to the public for recreation. We study the evolution of the CICLOVIA as an organism growing, adapting and coevolving with the city. The CICLOVIA connects parks spread throughout the city becoming a park 121 km long every sunday from 7 am to 2 pm. We study the evolution of the organization as an adapting network and as a growing network of parks.

Models and Implementation of Operational Systems for Development
Stream: OR for Development and Developing Countries
Invited session
Chair: Chandra Sekhar Pedamallu, Bioinformatics, New England BioLabs, 240 County Road, 01938, Ipswich, MA, United States, pcs.murali@gmail.com

1 - Dss platform for integrated assessment of cities occupation dynamics. case study, medellin metropolitan area-colombia
Claudia Rave, Energy Institute, National University of Colombia, AA 1027, crr 80 No 65 - 223, BL M2 of 112, 57, Medellín, Colombia, claudia.rave@gmail.com, Gloría Patricia Jaramillo, Y Olaya

An integrated platform for urban prospective planning, based on the analysis of city occupation models as a dynamic and defining process of the impacts and feedbacks between the citizen choices, land policy and mobility patterns has been designed and developed as a working model and supporting planning tool for decision making. The platform is based in the combination of different OR methodologies and a detailed spatially disaggregated application it’s being implemented for the metropolitan area of Aburrá valley (Colombia).

Forest Management I
Stream: OR in Agriculture and Forest Management
Invited session
Chair: Manfred Gronalt, Department of Economics and Social Sciences, Production and Logistics, University of Natural Resources and Applied Life Sciences, Vienna, Feistmantelstrasse 4, 1180, Vienna, Austria, manfred.gronalt@boku.ac.at

1 - Forest sustainability assessment from the representation of personal preferences on environmental comparisons
Susana Martin-Fernandez, Forest economy and management, Technical University of Madrid, Ciudad Universitaria sn, 28040, Madrid, Spain,
We have developed a participatory system for assessing the ecological sustainability at each point of a forest. For each individual, we obtain a representation of her/his environmental preferences from a comparison of the sustainability between different pairs of alternatives. We also identify the nature of the discrimination threshold. Then, we infer: sustainability on each spatial point; the analytical expression of the value function and type of rationality in the decisions. Finally, web2.0 resources are applied to aggregate individual preferences into communities with similar preferences.

2 - Optimizing pinus pinaster stand management scheduling, under the risk of fire

Liliana Ferreira, Rua do Convívio, nº 156 Telheiro - Barreirã, 2410-333, Leiria, liliana.ferreira@estg.ipleiria.pt

FERREIRA, L., CONSTANTINO, M., BORGES, J. We present a management scheduling model for pinus pinaster stands that take into account fuel treatments and the risk of fire. Stochastic dynamic programming is used to determine the expected financial value of the optimal prescription. Fire occurrence and damage probabilities are introduced in the model to analyze the impact of the risk of fire and alternative fire occurrence scenarios were considered at each stage. Results obtained by a test case show that the maximum stand expected financial value decreases when the risk of fire is considered.

3 - Analysis of the efficiency in a multiobjective forest management problem solved via a metaheuristic procedure.

Monica Hernandez, Applied Economics (Mathematics), University of Malaga, Faculty of Economics, Campus El Ejido s/n, 29071, Malaga, Spain, m_huelin@uma.es, Trinidad Gomez, Julian Molina, Maria Amparo Leon, Rafael Caballero

In this work, a forest harvesting planning problem is solved via a nonlinear multiobjective programming model where the economic factor of timber production is considered and also aspects related to environmental protection (as carbon captured). We also incorporate spatial constraints. The model proposed is applied to a timber production plantation in Cuba with a highly unbalanced age distribution, so we also try to rebalance age distribution by the end of the planning horizon. The result is a highly complex problem that is solved by applying a metaheuristic method based on Scatter Search.

4 - Integrated empty container management and vehicle routing in timber transport

Jan Zargornik, Feistmantelstrasse 4, 1180, Vienna, jan.zargornik@boku.ac.at, Manfred Gronalt, Patrick Hirsch

In this study foldable containers are used to transport wood products from forests to industrial sites and further on to customers. Therefore, a vehicle routing and container scheduling system is developed and formulated as a Mixed Integer Programming Model. The problem is state-dependent during execution and integrates empty container management and full truck routing. Larger problem instances are solved by a modified nearest neighbor insertion heuristic and improved by a metaheuristic called dynamic Tabu Search with Alternating Strategy, where neighborhoods are changed dynamically.
1 - High-order optimality conditions for nonlinear programming problems

Helmut Gfrerer, Institute for Computational Mathematics, Johannes Kepler University Linz, Altenbergerstr 69, A-4040, Linz, Austria, gfrrerer@numa.uni-linz.ac.at

We consider optimality conditions of Fritz-John type for mathematical programs with both equality and inequality constraints. We present so called no-gap necessary and sufficient conditions of arbitrary order. Similarly to the well-known cases of first and second-order conditions, a regularity condition on the equality constraints is required in order that the necessary conditions are meaningful. Surprisingly the amount of regularity requirements on the equality constraints decreases with the order of the conditions.

2 - Solving generalized fractional programming problems with approximation

S. Ilker Birbil, Manufacturing Systems/Industrial Engineering, Sabanci University, Orhanli, 34956, Tuzla, Istanbul, Turkey, sibirbil@sabanciuniv.edu, J.b.g. Frenk, Shuzhong Zhang

We propose a new approach to solve generalized fractional programming problems with approximation. Capitalizing on two alternatives, we review the Dinkelbach-type methods and set forth the main difficulty in applying these methods. To cope with this difficulty, we propose an approximation approach that can be controlled by a predetermined parameter. The proposed approach is promising particularly when it is acceptable to find an effective, but near-optimal value in an efficient manner. Finally, we support our discussion through numerical experiments.

3 - Increasing the demand in traffic equilibrium flows

Georg Still, Mathematics, University of Twente, P.O.Box 217, 7500 AE, Enschede, Netherlands, g.still@math.utwente.nl

The classical Wardrop traffic equilibrium concept is considered. We review the well-known sensitivity results of Hall for variable traffic demand. Then the equilibrium concept is generalized to the case of discontinuous cost functions. Characterizations and existence results for equilibria are extended to this general setting. We distinguish between strong and weak equilibria and show that the monotonicity results of Hall are no longer valid for the weak equilibria.
We consider the time-discrete systems with finite set of states and study the stochastic versions of classical discrete optimal control problems. We show that such kind of problems in general form can be formulated and studied on stochastic networks and new approaches for their solving based on concept of Markov's processes and dynamic programming can be proposed. We present some new results concerning determining optimal solution of the problems on networks with deterministic and random states transition of dynamical system.

Monday 13:35-14:55

MD-01

Monday 13:35-14:55

Beethoven

Non-linear combinatorial optimization problems

Stream: Combinatorial Optimization

Invited session

Chair: Adam Letchford, Department of Management Science, Lancaster University, Management School, LA1 4YX, Lancaster, United Kingdom, A.N.Letchford@lancaster.ac.uk

1 - A new linearization technique and its application to train platforming problems

Laura Galli, DEIS, University of Bologna, Viale Risorgimento, 2, 40136, Bologna, Italy, l.galli@unibo.it, Alberto Caprara, Sebastian Stiller, Paolo Toth

In this paper we study a general formulation of the train platforming problem and the corresponding robust counterpart. Motivated by our case study, we consider a general quadratic objective function, and propose a new way to linearize it by using a small number of new variables along with a set of constraints that can be separated efficiently by solving an appropriate linear program. The robust counterpart presents a non-linear link with the deterministic model that can be handled in a similar fashion.

2 - Knapsack-based cutting planes for the max-cut problem

Konstantinos Kaparis, School of Mathematics, University of Southampton, Highfield, Southampton, SO17 1BJ, Southampton, United Kingdom, k.kaparis@soton.ac.uk, Adam Letchford

We present a new procedure for generating cutting planes for the max-cut problem. The procedure consists of three steps. First, the minimum eigenvalue of a certain matrix is computed. Second, the associated eigenvector is used to construct a knapsack relaxation of the max-cut problem. Third, knapsack-based cutting planes are generated using existing techniques from the literature. Although the resulting cutting planes typically do not define facets of the cut polytope, they are still rather strong in practice.

3 - Convex reformulations for binary quadratic programs

Amélie Lambert, CEDRIC, CNAM, 292 rue saint martin, 75141, paris, france, amelie.lambert@cnam.fr, Alain Billionnet, Sourour Elloumi

Let (QP) be a binary quadratic program that consists in minimizing a quadratic function subject to linear constraints. To solve (QP) we formulate it into an equivalent program with a convex objective function. Our reformulation, that we call EQCR (Extended Quadratic Convex Reformulation), is optimal from the continuous relaxation bound point of view. We show that this best reformulation can be deduced from the solution of a semidefinite relaxation of (QP) and that EQCR outperforms QCR. We present computational experiments on Max-Cut and on the k-cluster problem.
Extended Vehicle Routing and Scheduling

Stream: Transportation Planning
Invited session
Chair: Stefan Irnich, Deutsche Post Endowed Chair of Optimization of Distribution Networks, RWTH Aachen University, Templergraben 64, 52062, Aachen, Germany, s.irnich@or.rwth-aachen.de

1 - Combining vehicle routing with forwarding

Xin Wang, Business Studies & Economics, University of Bremen, Chair of Logistics, Wilhelm-Herbst-Straße 5, 28359, Bremen, Germany, gongyiche@hotmail.com, Herbert Kopfer

Efficiency of transportation request fulfillment can be increased by subcontracting requests to outside carriers. This problem extension transforms usual vehicle routing problems to the more general integrated operational transportation problems. In this contribution the Vehicle Routing Problem is extended with diverse sub-contraction types. The problem is formalized as a mixed integer linear programming model and solved by CPLEX. Results show tremendous cost savings even for small problem instances by allowing subcontracting. Optimal fleet size for own and hired vehicles are also analyzed.

2 - Minimization of the manufacturer's distribution costs in the supply chain — a case study

Pawel Hanczar, Department of Logistics, University of Economics, ul. Komandorska 118/122, 54-608, Wroclaw, pawel.hanczar@ae.wroc.pl

In the paper, the situation where a manufacturer orders transportation services from an external company is taken into consideration. In the first part of the paper, basic definitions are introduced. Then possible models for a solution to the problem presented are discussed. In order to solve this issue, two linear programming formulations based on the set partitioning model and on the vehicle routing problem have been developed. The last part of the paper describes the application of this model to planning routes. Additionally, the integration with the R3 system is discussed in detail.

3 - Pickup and delivery with dynamic freight consolidation: a near real-time optimization problem

Curt Nowak, Betriebswirtschaft und Wirtschaftsinformatik, Stiftung Universität Hildesheim, Samelsonplatz 1, 35141, Hildesheim, Germany, cinowak@bwl.uni-hildesheim.de, Felix Hahne, Klaus Ambrosi

Large scale pickup and delivery providers continuously face very complex dynamic Vehicle Routing Problems (VRPPD). When orders are submitted within short intervals, new transportation plans must be calculated very quickly preventing the use of conventional search strategies for optimal solutions. Yet, if time windows allow for reloads the shipping volume and overall travel distance can be improved by combining freight on vehicles. This paper demonstrates a fast strategy for dynamic freight consolidation applicable to large scale VRPPD. Test results based on real life data will be presented.
Renault’s Vehicle Documentation is built upon version and options. Options are linked by constraints within a model, e.g. SR (sunroof) \( \Rightarrow \) ABS. These constraints are forming a graph. The complexity indicator for a graph is its number of circuits. We used Tarjan’s algorithm to build it. For most models it runs within 15 minutes. The complexity of Tarjan’s algorithm is \( O(nm(C+1)) \), where \( n \) is the number of nodes, \( m \) the number of arcs, and \( C \) is the number of elementary circuits. Tieman has proved that \( C \) has an upper bound which is proportional to the integral from 0 to \( n \) of the Gamma function.

**MD-04**

Monday 13:35-14:55

**Liszth**

**Scheduling in Health Care**

Stream: Scheduling

*Invited session*

Chair: Dobrila Petrovic, Faculty of Engineering and Computing, Coventry University, Priory Street, CV1 5FB, Coventry, United Kingdom, D.Petrovic@coventry.ac.uk

1 - Multiobjective scheduling of radiotherapy cancer patients

Mohammad Sarvar Morshed, Control Theory and Applications Centre, Faculty of Engineering and Computing, Coventry University, Priory Street, CV1 5FB, Coventry, United Kingdom, m.morshed@coventry.ac.uk, Dobrila Petrovic, Sanja Petrovic

This research concerns a multiobjective scheduling of radiotherapy cancer patients in Arden Cancer Centre, University Hospitals Coventry and Warwickshire, UK. Genetic Algorithms (GA) based model has been developed and implemented. Two objectives are defined: minimisation of Average patient’s waiting time and minimisation of Average tardiness of the patients’ first fraction. The developed GA incorporates a domain specific knowledge in creating initial solutions and in the genetic operators. The schedules generated by the GA using real data collected from the Cancer Centre have good performance.

2 - A mathematical programming model for the radiotherapy pre-treatment scheduling problem

Elkin Castro, School of Computer Science, University of Nottingham, Jubilee Campus, Wellaton Road, NG8 1BB, Nottingham, United Kingdom, edc@cs.nott.ac.uk, Sanja Petrovic

Demand for radiotherapy treatment services has increased due to aging population, higher cancer incidence, and a larger number of prescribed radiotherapy fractions. This higher demand can in turn produce longer waiting times which negatively impact the health of patients. This research work is concerned with the radiotherapy pre-treatment scheduling problem present in the Nottingham City Hospital, Nottingham University Hospitals NHS trust. A mathematical programming formulation of this problem is given, and valuable insights into future developments are provided through experimental tests.

3 - Optimization based approaches for the planning and the management of week-hospital services

Rosita Guido, University of Calabria, 87036, Rende, Italy, rguido@deis.unical.it, Marco Matteucci Cerenic, Domenico Conforti, Maria Letizia Conforti, Francesca Guerriero

The Week Hospital is a new inpatient health care delivery organization, which consists in delivering hospital medical services on week-time basis for selected group of patients. The most important problem is to effectively and efficiently plan and manage all the relevant hospital resources, ensuring the optimal clinical management of the admitted patients. We propose innovative optimization models to address the problem under study and we evaluate their performance by considering both randomly generated instances and real data coming from General Hospital Careggi, Florence, Italy.

4 - An optimal scheduling tool for emergency departments

Mel Diefenbach, School of Mathematical Sciences, Queensland University of Technology, 2 George St, 4000, Brisbane, QLD, Australia, m.diefenbach@qut.edu.au, Erhan Kozan

An overview of the Emergency Department (ED), its complexities, processes, resources, demands and performance measures are explored in this paper. The complexity of the system is increased by the stochastic nature of the problem. The ED is modelled as a dual resource job shop problem to handle this complexity. The beds and doctors are assumed as the machine resources and the patients are assumed synonymous with the jobs. The model aims to optimise the multi-criteria objectives. Objectives include waiting time performance, access block, bed utilisation, doctor utilisation and tardiness.

**Bioinformatics I**

Stream: Computational Biology, Bioinformatics and Medicine

*Invited session*

Chair: Ceyda Oğuz, Department of Industrial Engineering, Koc University, Rumeli Feneri Yolu, Sarıyer, 34450, İstanbul, Turkey, coguz@ku.edu.tr

1 - Isothermic sequencing by hybridization with additional information available

Piotr Formanowicz, Institute of Computing Science, Poznan University of Technology, Piotrowo 2, 60-965, Poznan, Poland, piotr@cs.put.poznan.pl

Sequencing by hybridization (SBH) is one of the methods of reading DNA sequences. It is composed of biochemical and computational stages. Since its classical version is very sensitive for errors some variants of the basic approach are being developed. Isothermic SBH with additional information is one of them. In this variant of the method in the biochemical stage an isothermic DNA chip is used and moreover, the resulting spectrum contains partial information about repeated subsequences. This leads to a formulation of new combinatorial problems which must be solved in the computational stage.

2 - An mdp approach for the optimal issuing policy of a blood product

René Haijema, Operations Research and Logistics, Wageningen University and Research center, Hollandseweg 1, 6706 KN, Wageningen, Netherlands, rene.haijema@wur.nl
Medicines strongly prefer to get the youngest platelet pools available. To reduce outdated one carefully has to choose which pools to issue from stock. Through a (fictional) cost structure one may specify the preference for young pools, and assign costs for outdated and shortages. When only the short term demand is known, one is interested which pools to issue from stock to minimize the long-run average cost of the issuing policy. We have formulated the issuing problem as a Markov decision problem (MDP). The approach has the potential to contribute to a better transfusion practice.

3 - Exact crossing minimization in general tanglegrams
Frauke Liers, Institut fuer Informatik, Universitaet zu Koeln, Pohligstrasse 1, 50969, Koeln, Germany, liers@informatik.uni-koeln.de, Frank Baumann, Christoph Buchheim

A tanglegram consists of a pair of general trees where additional tangle edges may connect their leaves. The task is to draw it with a minimum number of tangle edge crossings, without inducing a crossing within a tree. Applications exist in computational biology. We model the task as a quadratic linear ordering problem QLO with side constraints. As QLO is a face of some cut polytope and the constraints maintain this property, any polyhedral approach to max-cut can be used. We present results using linear and semidefinite programming, showing that our approach is fast in practice.

4 - Gevadd - system for development and standardized evaluation of novel genetic vaccines
Piotr Lukasiak, Institute of Computing Science, Poznan University of Technology, ul.Piotrowo 2, 60-965, Poznan, Poland, Piotr.Lukasiak@cs.put.poznan.pl, Jacek Blazewicz, Pawel Wojciechowski, Marcin Borowski, Pawel Kedziora

Recombinant viral vectors and virus-like particles are considered the most promising vehicles to deliver antigens in prophylactic and therapeutic vaccines against infectious diseases and cancer. Several potential vaccine designs exist but their cost-effective development crucially lacks a standardized evaluation system. GeVADSS (Genetic Vaccine Decision Support System) will contain standardized data related to defined gold standard antigens and methods used to assess immune responses as well as algorithms allowing the intelligent comparison of new vectors to previously analyzed ones.

1 - Supply chain risk modeling from global logistics perspectives
Hokey Min, College of Business Administration, Bowling Green State University, 43404, Bowling Green, OH, United States, hmin@bgsu.edu

Due to increased complexity and uncertainty, a global supply chain is often characterized by various risks. Indeed, the recent McKinsey report indicates that nearly a quarter of surveyed company executives did not have any formal risk assessment tools and nearly half of them never formulated company-wide strategies to mitigate supply chain risks. To better cope with challenges of global supply chain operations, we would bring up fruitful research agenda that address open research questions regarding risk profiling, risk analysis, risk sharing, risk tuning, and risk-related change management.

2 - Transshipment port selection using the hybrid dea/ahp methodology
Byung-In Park, Department of Logistics, Chonnam National University, San 96-1, Dundeok-dong, 550-749, Yeosu, Chonnam, Korea, Republic Of, bipark@chonnam.ac.kr, Hokey Min

The accelerated globalization of logistics activities over the last several decades spurred a rapid expansion of ports all over the world. However, the recent slowdown of international trade created the on-going glut of ports throughout the world. Although the abundance of ports provides more transshipment options for carriers, it makes the port selection decision more complex. To cope with this complexity, this paper proposes a hybrid DEA/HP model that is designed to identify factors influencing port selection, evaluate the relative efficiency of ports, and then select the best port.

3 - A game-theoretic volume discount model in global maritime logistics
Byung-In Park, Department of Logistics, Chonnam National University, San 96-1, Dundeok-dong, 550-749, Yeosu, Chonnam, Korea, Republic Of, bipark@chonnam.ac.kr, Soak-Kyung Sung, Hokey Min

Maritime logistics firms impose port service charges on their customers. To continually attract their customers, these firms need to develop a viable port service charge structure. Nevertheless, the volume discount or incentive structure in the marine logistics industry was operated by a simple rule-of-thumb. As a viable alternative such a rule of thumb, this paper proposes a cooperative game-theoretical approach that is designed to handle the volume discount based on the customer’s cargo volume or the number of calling ships.

4 - Modeling techniques and solution approaches for maximizing fleet availability of mission aircraft subject to flight and maintenance requirements
Andreas Gavranis, Mechanical &Industrial Engineering, University of Thessaly, Leoforos Athletic, Pedion Areos, 38334, Volos, Magnisia, Greece, agavranis@gmail.com, George Kozanidis

Flight and Maintenance Planning (FMP) addresses the question of which available aircraft to fly and for how long, and which grounded aircraft to perform maintenance operations on, in a group of aircraft that comprise a unit. We compare several modeling techniques for the FMP problem. We report our computational experience with heuristic approaches, we elaborate on their computational complexity, and we discuss the effect of different design decisions on their performance. We also propose an exact solution procedure that can handle multiobjective FMP instances quite efficiently.

MD-06

Global logistics modeling
Stream: OR and Real Implementations

Invited session
Chair: Hokey Min, College of Business Administration, Bowling Green State University, 43404, Bowling Green, OH, United States, hmin@bgsu.edu

1 - Supply chain risk modeling from global logistics perspectives
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MD-07

Railway Disruption Management
Stream: Optimization in Public Transport

Invited session
Chair: Dennis Huisman, Econometric Institute, Erasmus University, Rotterdam, Netherlands, huisman@few.eur.nl

1 - Dispatching support system for a main station area
Martin Fuchsberger, D-Math, Institute for Operations Research, ETH Zurich, Rämistrasse 101, 8092, Zurich, Zurich, Switzerland,
We address the problem of conflict-free dispatching of trains in main station areas. Our model is based on an integer multi-commodity flow formulation that incorporates the detailed railway topology, dynamics and delays of the trains as well as connection requirements. Our mixed objective considers minimizing delay propagation and broken connections. The resulting integer program is solved with a commercial solver. Tests with data from Berne, Switzerland show that with this model it is possible to find feasible solutions in appropriate time.

2 - Capacity oriented rolling stock rescheduling in passenger railways

Lars Nielsen, Department of Decision and Information Sciences, Rotterdam School of Management, Erasmus University Rotterdam, Burgemeester Oudlaan 50, Room T09-24, 3062 PA, Rotterdam, Netherlands, lnielsen@rsm.nl, Leo Kroon, Gabor Maroti

The rolling stock planning at the major Dutch passenger railway operator NS is based on the expected number of passengers on the timetabled trains. These come from observations of passenger traveling patterns on similar days in previous years. In case of disruptions or serious delays the flow of passengers changes as some passengers change their route or choose other means of transportation. We present a model for rolling stock rescheduling that considers the flow of passengers in the time expanded railway network combined with the rolling stock units assigned to the timetable services.

3 - Railway crew rescheduling under uncertainty

Daniel Potthoff, Econometric Institute, Erasmus University Rotterdam, P.O. Box 1738, 3000 DR, Rotterdam, Netherlands, pothoff@ese.eur.nl, Dennis Huisman

The Dutch railway network experiences about three large disruptions per day on average. Algorithms for crew rescheduling usually assume that the duration of the disruption is known. In reality however, disruptions sometimes last longer than expected. In this talk, we will discuss how a column generation based rescheduling algorithm can be extended in order to deal with this uncertainty. We will present results for real-life instances and compare our method with a wait-and-see approach.

This paper addresses the vehicle routing problem with variable virtual depots. The goal of the operation minimizes the total travel and waiting cost for all vehicles while balanced workload among drivers is also considered. In this problem, a large vehicle departs from a physical depot (PD), services all virtual depots (VDs), and then returns to the PD. A set of smaller vehicles positioned at the PD deliver services to ordinary customers within given time constraints and, if necessary, reloads the commodity on route from either the PD or from the larger vehicle at a VD before continuing work.

2 - Investigation of multi-period inventory routing management strategies with stochastic demands using simulation

Chao-Hua Chen, Department of Transportation Technology and Logistics Management, Chung Hua University, 707, Sec.2, WuFu Road., 300, Hsinchu, Taiwan, erchen@chu.edu.tw

The inventory routing problem involves with the coordination decisions of at what time and with what quantities, as well as by how many trucks and what routes in carrying out replenishment works within a supplier-customer system under a preferred level of customer service. This study proposes new replenishment strategies and investigates their effects on the related costs and the trade-off effect between inventory and transportation cost for a multi-period IRP with stochastic demands. Simulation along with linear programming method is used to perform the modeling and analysis.

3 - Application of hybrid meta-heuristic method on the multi-temperature co-delivery routing

Yuh-Jen Cho, Department of Transportation Technology and Logistics Management, Chung Hua University, No. 707, Sec. 2, WuFu Rd., 30012, HsinChu, Taiwan, yjcho@chu.edu.tw, Yu-Ning Tseng

This study proposed a model named as the Hybrid Multi-Temperature Co-delivery Vehicle Routing Problem (HMCVRP), and designed a RASTA (Ranked Ant System with Threshold Accepting) procedure that combined the neighborhood search methods with threshold accepting algorithm into a scheme of the AStrank algorithm to solve the HMCVRP. In order to identify the feasibility of RASTA, a bank of 30 instances was generated and five experiments were conducted to analyze the computational performance. Computational results shown that the proposed RASTA can solve the HMCVRP effectively.

4 - Mixed hub-and-spoke intra-network routes design for the fixed-route trucking carriers

Chien-Yen Chang, Department of Transportation Technology and Logistics Management, Chung Hua University, No. 707, Sec. 2, WuFu Rd., 300, Hsin Chu, Taiwan, axle@chu.edu.tw, Yuh-Jen Cho, Chia-Chun Wu

The intra-network of a fixed-route trucking carrier can be transferred into a hub-and-spoke network. The purpose of this study is to propose a model of routes design for the intra-network, named as the Mixed Hub-and-Spoke Network Routing Problem (MHSNRP). A heuristic method is developed to solve the MHSNRP. In order to evaluate the MHSNRP and the heuristic method, we generate a set of 72 MHSNRP instances and code a computer program in C# language to conduct the experimental tests. Results show that the proposed MHSNRP is full of potential to the intra-network routes design.
1 - Strategic design of competing supply chain networks with foresight

Shahnam Rezapour, Amirkabir university, Amirkabir university, Tehran, Iran., ITSR, Tehran, Iran., 12345, Tehran, Iran, Islamic Republic Of, s_rezapoor@ut.ac.ir, Reza Zanjirani Farahani

We consider a model for duopolistic competitive supply chain network designing with sequential acting and variable delivered prices. The model designs a multi-tier chain operating in markets under deterministic price-depended demands and with a rival chain present. The existing chain tends to open some new retailers to recapture some income in a near future. The chains’ structures are assumed to be set “once and for all” in a sequential manner but further price adjustments are possible. This problem is modeled by a linear bi-nary bi-level program and solved by a combinatorial meta-heuristic.

2 - Multi-echelon logistics network design with fuzzy bi-level programming

Umut Rifat Tuzkaya, Industrial Engineering, Yıldız Technical University, YTU, Department of Industrial Engineering, Yıldız, Beşiktaş, 34349, Istanbul, Turkey, tuzkaya@yildiz.edu.tr, Semih Onut

This study considers a multi-echelon logistics network and deals for optimizing bi-level structured objectives simultaneously. The objective of the first level is related with the overall network and the objectives of the lower level consider the echelons of the network separately. The developed bi-level multi-objective 0-1 integer linear programming model is formed to determine the amount of each product, which should be shipped among the locations, during a planning horizon. A numerical example is given to show the applicability of the model and it is solved by fuzzy programming approach.

3 - Empirical-based scenario analysis of strategic impact factors

Tobias Klatt, Chair of Management Accounting and Control, University of Goettingen, Platz der Göttinger Sieben 3, 37079, Göttingen, Germany, Tobias.Klatt@wiwi.uni-goettingen.de

Strategic planning still lacks an empirical foundation while accessible data is mostly used only for descriptive purposes. To fill this gap an empirical quantitative approach for strategic scenario planning is developed that applies time-series data for management decision support. The employment of vectorautoregressive models on the case of the German construction industry supplies evidence on time-displaced impacts of external factors as well as on outcomes of alternative developments in these trends. This environmental scanning reveals needs for action concerning the strategic positioning.

4 - Reengineering of the information and materials flow systems in the supply chain

Agnieszka Ponikierska, Institute of Management Engineering, Poznan University of Technology, ul. Strzelecka 11, 60 - 965, Poznan, Poland,
Agnieszka.Ponikierska@gmail.com, Katarzyna Grzybowska

Currently observed global trends and economic transformations influence the activities and changes in supply chain in a radical way. In this way is necessary to search a new organisation solutions and new concepts of management which would allow to lower the costs of the activity and as a result would grow the competitiveness on the market. The implementation of Just in Time, Quick Response, Vendor Management Inventory systems and outsourcing process in the supply chain should lead to the reengineering in an integrated supply chain and to achieving the intended effect of chain functioning.
The Decision Deck project

Stream: Multiple Criteria Decision Analysis

Invited session

Chair: Raymond Bisdorff, CSC/ILIAS, University of Luxembourg, 6, rue Richard Coudenhove-Kalergi, L-1359, Luxembourg, Luxembourg, raymond.bisdorff@uni.lu

Chair: Patrick Meyer, LUSSI, Telecom Bretagne, Technopole Brest-Iroise CS 83818, 29238 Brest Cedex 3, 29238, Brest, France, patrick.meyer@telecom-bretagne.eu

1 - News and perspectives from the decision deck project

Vincent Mousseau, LGI, Ecole Centrale Paris, Grande voie des vignes, 92 295, Chatenay Malabry, France, vincent.mousseau@ecp.fr, Marc Pirlot, Raymond Bisdorff

The Decision Deck project aims at collaboratively developing software tools implementing Multiple Criteria Decision Aid. Its purpose is to provide effective tools for three types of "users": - practitioners who use MCDA tools to support actual decision makers involved in real world decision problems, - teachers who present MCDA methods in courses, for didactic purposes, - researchers who want to test and compare methods or to develop new ones.

The aim of this presentation is to detail the latest developments of the Decision Deck project.

2 - Xmcdoa: a standard xml encoding of MCDA data

Raymond Bisdorff, CSC/ILIAS, University of Luxembourg, 6, rue Richard Coudenhove-Kalergi, L-1359, Luxembourg, Luxembourg, raymond.bisdorff@uni.lu, Patrick Meyer, Thomas Veneziano

XMCDoa is a structured XML proposal to represent objects and data issued from the field of MCDA. Its main objectives are to allow different MCDA algorithms to interact and to be easily callable from a common platform like Decision Deck diviz. We present this standardized XML structure and detail the underlying data types via examples speaking for themselves.

3 - Diviz: an MCDA components workflow execution engine

Thomas Veneziano, CSC, University of Luxembourg, Université du Luxembourg, FSTC, 6, rue Richard Coudenhove-Kalergi, 1359, Luxembourg, Luxembourg, thomas.veneziano@uni.lu, Sebastien Bigaret, Patrick Meyer

diviz is a software platform, derived from the open source Bioside software, which aims at helping researchers to build MCDA workflows based on elementary algorithmic components available as web services. We focus on the use of components originating from kappalab, an R library, which can be used for Choquet integral based MCDA.

Stochastic Mixed Integer Programming Algorithms and Applications

Stream: Stochastic Programming

Invited session

Chair: Laureano Fernando Escudero, Dept. de Estadística e Investigación Operativa, Universidad Rey Juan Carlos, c/Tulipan, S/n, 28933, Mostoles (Madrid), Spain, laureano.escudero@urjc.es

1 - Branch-and-fix coordination approach for the mixed 0-1 multistage environment: a set of strategies

Maria Merino, Matemática Aplicada, Estadística e Investigación Operativa, Facultad de Ciencia y Tecnología. Universidad del País Vasco, Barrio Sarriena s/n, 48940, Leioa, Vizcaya, Spain, maria.merino@ehu.es, Laureano Fernando Escudero, Maria Merino, Gloria Pérez

We present a specialization of the Branch-and-Fix Coordination approach for multistage mixed 0-1 stochastic problems where the 0-1 and continuous variables appear at any stage. It uses the Twin Node Family (TNF) concept and is designed for coordinating and reinforcing the branching nodes and variable selections at each Branch-and-Fix tree. Some blocks of additional strategies (related to the cluster partitioning, the TNF branching selection and bounding, the starting branching and branching order) are proposed to increase the efficiency of the approach. Computational experience is reported.

2 - On the performance of the bfc-tsmip algorithm

Maria Araceli Garín, Economía Aplicada III, Universidad del País Vasco, Lehendakari Aguirre 83, 48015, Bilbao, Spain, Spain, mariaaraceli.garin@ehu.es, Laureano Fernando Escudero, Maria Merino, Gloria Pérez

In the Branch-and-Fix Coordination scheme for solving large scale two-stage stochastic problems, we consider two classes of mixed 0-1 problems: with 0-1 and continuous variables in the two stages, and with continuous variables in the second stage. The approach uses the Twin Node Family concept in order to satisfy the nonanticipativity constraints for the 0-1 first-stage variables. For satisfying the nonanticipativity constraints also on the first-stage continuous variables, we need to solve two submodels of the DEM, for the given TNF integer set. Computational experience is reported.

3 - On the air traffic flow management problem: a stochastic integer programming approach

Alba Agustin, Statistic and Operational Research, Rey Juan Carlos University, c/ Maestro Navas, 10, 4B, 28011, Madrid, Spain, alba.agustin@urjc.es, Pablo Olaso, Antonio Alonso-Ayuso

We present a tight stochastic 0-1 programming model for the air traffic flow management problem on a short term policy. The problem consists of deciding, for each aircraft, how to develop the route to follow and cancellation, if any, according to company priorities. We consider the uncertainty in the capacity of the departures and arrivals at airports and the number of aircrafts that may fly on a sector, at a given time. We create an air network whose links describe all given possible routes, such that alternative routes to the main one are allowed. Some computational experience is reported.
Stochastic programming II.
Stream: Stochastic Programming

Invited session
Chair: Michael Bussieck, GAMS Software GmbH, Eupener Str 135-137, 59033, Cologne, Germany, MBussieck@gams.com

1 - A progressive hedging algorithm for a stochastic lot sizing and pricing problem

Hongyan Li, Department of Business Studies, Aarhus School of Business, 8210, Aarhus, hojl@ash.dk

We address a capacitated lot sizing and pricing problem for a single product firm. The firm makes production and price decisions under stochastic and price dependent demands. Fixed and variable unit production costs are considered. The inventory holding cost or backlogging cost will be charged for excess production or demand. We model the problem as a stochastic MIP model, and a heuristic algorithm is developed. The study accommodates the complexity of time varying cost and market uncertainty, and incorporates pricing decisions with traditional production and inventory planning process.

2 - Capacity planning and capital expenditure for participation in collaborative provision of advanced mobile data services

Paolo Pisciella, Norwegian University of Science and Technology, 7491, Trondheim, Norway, paolo.pisciella@iot.ntnu.no, Alexei Gaivoronski, Josip Zoric

This paper considers a bilevel single-leader/multi-follower model underlying the collaborative provision of advanced mobile data services when facing a stochastic demand level. The bilevel structure is exploited by considering, in the lower level, a set of service providers making decisions regarding the initial capacity, while in the upper level the leader decides on how to share the revenues to make the service provision feasible, while considering a stochastic demand level for the service. This results in a stochastic programming problem for each component provider.

3 - Stochastic optimization: recent enhancements in algebraic modeling systems

Michael Bussieck, GAMS Software GmbH, Eupener Str 135-137, 59033, Cologne, Germany, MBussieck@gams.com

With all the uncertainty in data there is considerable demand for stochastic optimization in operational, tactical and strategic planning. Nevertheless, there exist a fairly small number of commercial applications building on stochastic optimization techniques. After a decade without much progress on the software side, modeling system providers have recently entered the second round of making it easier to go from a deterministic model to a stochastic version of such a model. We will review the different concepts emphasizing on recent enhancements in the GAMS system.
2 - Location of capacitated depots for the vehicle routing problem

Roberto Wolfler Calvo, L.O.S.I., Université de Technologie de Troyes, Troyes, France, roberto.wolfler@utt.fr, Roberto Baldacci, Aristide Mingozzi

We consider the Capacitated Location Routing Problem (CLRP), the problem of opening one or more depots on a given set of a priori defined depot locations and to design for each opened depot a number of routes in order to supply a given set of customers. The objective is to minimize the sum of the fixed costs of the opened depots and of the costs of the routes operated by the depots. We describe an exact method that is based on a Set Partitioning (SP) formulation of the problem that is a generalization of the SP formulation of the Capacitated VRP and of the Multi-Depot CVRP.

3 - The generalized covering salesman problem

Majid Salari, DEIS, University of Bologna, Viale risorgimento 2, 40136, Bologna, Italy, majid.salari2@unibo.it, Zahra Naji Azimi, Bruce Golden, S. Raghavan, Paolo Toth

We define the Generalized Covering Salesman Problem, in which the goal is to identify the minimum length tour of a subset of cities such that each city not on the tour is within a given distance from the visited nodes, and each customer i needs to be covered at least times. We define three variants of this problem. In the first case, each city can be visited just once, while in the second version visiting a node more than once is possible but without staying overnight. In the last variant, we can visit each city more than once consecutively. Finally we present two heuristics for these problems.

4 - The pickup and delivery problem with incompatibility constraints

Pablo Factorovich, Computer Science Department, University of Buenos Aires - Science School, Angel Gallardo 555 1º 10, 1405, Buenos Aires, Argentina, pfactor0@dc.uba.ar, Isabel Méndez-Díaz, Paula Zabala

In the Pickup and Delivery Problem (PDP) a vehicle must accomplish a set of requests, each one related to pickup node preceding a delivery one. In many scenarios, certain goods cannot be on the vehicle simultaneously (e.g. food & detergents). To model them, a variation of PDP can be defined by adding an “incompatibility graph” to be obeyed. This problem (PDPwI) has not been described yet in the literature. In this research we propose four formulations for PDPwI and we algorithmically compare them. One of these models is based on variables that were not previously used in routing literature.

MD-17

Monday 13:35-14:55
Rheinaue

Cutting and Packing 2

Stream: Cutting and Packing

Invited session

Chair: Gleb Belov, Numerical Mathematics, TU Dresden, 01062, Dresden, Germany, bg37@gmx.net

1 - A just-in-time intelligence framework to the bin packing problem

Sergey Polyakovskiy, Department of Computer Science and Robotics, Ufa State Aviation Technical University, Oktiabrya pr., 45-19, 450058, Ufa, Russian Federation, maxles@yandex.ru, Rym Mhallah

We address the Bin Packing Problem under the Just-In-Time condition. Indeed, the items are to be extracted from bins exactly on due dates; otherwise they incur earliness-tardiness penalties. We minimize penalties along with the wastes of bins using an Agent-Based (AB) framework. AB identifies critical areas consisting of clusters of items competing for the same time slot, and assimilates the items and bins to agents. Driven by their parameters, decision rules, and fitness assessment agents collaborate to obtain a solution. AB proves flexibility and offers a stable and robust work environment.

2 - Sawmbs: a sufficient-average-weight-minimum-bin-sack heuristic for one-dimensional bin-packing

Krzysztof Pleszar, Olayan School of Business, American University of Beirut, P.O. BOX 11-0236, Riad El Solh, 1107 2020, Beirut, Lebanon, kleszar@gmail.com, Christotories Charalambous, Khalil Hindi

A sufficient-average-weight-minimum-bin-sack (SAWMBS) heuristic for the one-dimensional bin-packing problem is presented. It fills bins one at a time, optimising a bicriteria objective, which aims first at achieving average item weight at least as large as the average weight of all currently available items, and secondly at minimising slack. Thus, bin capacity is well utilised without packing too many small items. Reductions are also used to improve solutions and reduce processing time. Computational study attests to the efficiency and effectiveness of SAWMBS.

3 - A new lower bound for bin packing problem with general conflicts graph

Mohamed Maiza, EMP BP17 Bordj El Bahri, 16111, Alger, Algeria, mohamed.maiza@enm.fr, Christelle Gueret, Pierre Lemaire, Mohammed Said Radjef

We propose a new lower bound for the one dimensional bin packing problem with conflicts. The conflicts are represented by a graph whose nodes are the items, and adjacent items cannot be packed into the same bin. The lower bound is based on an iterative search of maximal cliques in the conflict graph using Johnson’s heuristic. At each step we delete from the graph the items of the last clique found, together with small items that could eventually be packed with them. The lower bound corresponds to the sum of the bins required at each step.

MD-17

Monday 13:35-14:55
Rheinaue

Scheduling and Applications

Stream: Scheduling under Resource Constraints

Invited session

Chair: Malgorzata Sterna, Institute of Computing Science, Poznan University of Technology, Piotrowo 2, 60-965, Poznan, Poland, Malgorzata.Sterna@cs.put.poznan.pl

1 - Scheduling tasks in web service for text translation

Malgorzata Sterna, Institute of Computing Science, Poznan University of Technology, Piotrowo 2, 60-965, Poznan, Poland, Malgorzata.Sterna@cs.put.poznan.pl, Jacek Juraszek
The research concerns the scheduling tool supporting the web service offering automatic text translation between Polish and 3 other languages. The system consists of a few translation processes dedicated to particular translation directions, running in parallel and sharing hardware resources. After the analysis of historical data obtained for a simple random scheduler, we proposed an on-line scheduling policy based on priority dispatching rules. The new scheduler improved the efficiency of the system, increasing significantly the percentage of orders realized within a given time limit.

2 - Agent driven scheduling model in the multi-line production system

Grzegorz Pawlak, Institute of Computing Science, Poznan University of Technology, ul. Piotrowo 2, 60-965, Poznan, Poland, grzegorz.pawlak@cs.put.poznan.pl, Slawomir Walskowski, Tomasz Zurkowski

The variety of possible configurations of the currently used production lines, their structures and control methods make them a natural application field for the agent based scheduling systems. The goal of our research was to model and to analyze production processes in the real factory floor, taking into account the structure of its production lines, in order to work out proper management models and the efficient adaptive control. Particularly, we analyzed the state of the buffer and of the switch where two or more production lines are joined, as well as the velocity of the assembly lines.

3 - On scheduling divisible loads with memory constraints

Maciej Drozdowski, Dept. of Computer Science and Management, Institute of Computing Science, Poznan University of Technology, Piotrowo 2, 60-965, Poznan, Poland, Maciej.Drozdowski@cs.put.poznan.pl, Joanna Berlinska

We consider processing divisible loads on heterogeneous distributed systems with limited memory. Divisible loads are computations which can be divided into parts of arbitrary sizes and can be processed independently on distributed computers. The problem consists in partitioning and distributing the load such that the schedule is as short as possible. We formulate this problem as a mathematical programming problem and propose heuristics to solve it. A set of heuristics non-dominated from the point of view of complexity and the quality of the solutions is identified experimentally.

4 - The last station problem in assembly lines

Waldemar Grzechca, Faculty of Automatic Control, Electronics and Computer Science, The Silesian University of Technology, Akademicka 2A, 44100, Gliwice, Poland, waldemar.grzechca@polsl.pl

Nowadays, a good balanced assembly line is a very important factor in modern manufacturing companies. Even small differences is assigning of tasks on workstations can cause great profits or losses for producers. The line efficiency, time of the line and smoothness index is the basic measures in estimation of final results. The differences of balance and equalization in assembly line are considered. Author discusses the problem of the last station and a modified smoothness index is presented. As a conclusion, a numerical example will be calculated.

Modern Applications of Mathematical Programming II

Stream: Mathematical Programming

Invited session

Chair: I. Kuban Altinel, Industrial Engineering Dept., Bogazici University, Bebek, 34342, Istanbul, Turkey, altinel@boun.edu.tr

1 - Topological properties of the solution set of generalized vector equilibrium problems

Kamelia G. Alizadeh, sahand University of technology, 513351996, Tabriz, Iran, Islamic Republic Of, kamelia_alizadeh@yahoo.com, Ildar Sadeqi

In this paper, a generalized vector equilibrium problem (GVEP) with set-valued maps on a reflexive Banach space is considered. It is known that the solution set fails to be nonempty and convex in general. Using the recession method, we give conditions under which the solution set is nonempty, convex and weakly compact, then extend it to the strongly generalized vector equilibrium problem (SGVEP). This result in generalizing and modifying various existence theorems. Also we study topological properties of the solution set to the same problems.

2 - Multiparametric sensitivity analysis in transportation problems with linear-plus-linear fractional objective function

Sanjeet Singh, Operations Management, Indian Institute of Management Calcutta, D.H. Road, Joka, Kolkata, 700104, Kolkata, West Bengal, sanjeet@iimcal.ac.in, Pankaj Gupta, Milan Vlach

In this paper, we provide the multi-parametric sensitivity analysis of a transportation problem whose objective function is the sum of linear and linear-fractional function. We construct critical region for simultaneous and independent changes in the objective function coefficients treating each parameter at its independent level of sensitivity. A numerical example is given to illustrate the multiparametric sensitivity analysis results. We also extend the sensitivity results to the three index transportation problem with planar constraints as well as axial constraints.

3 - When every function evaluation counts: an efficient optimizer for high-dimensional problems and a bootstrap standard error estimation of a psychological behavior model

Thomas Buchsbaum, Dept. of System Analysis, Integrated Assessment, and Modeling (Siam), Eawag - Swiss Federal Institute of Aquatic Science and Technology, Ueberlandstrasse 133, P.O. Box 611, 8600, Duebendorf, Switzerland, buchsbaum@ieee.org

I present an efficient, almost global optimization approach (EAGO) that aims at finding a reasonably good minimum of disturbed-convex functions with a very small number of function calls. This makes the algorithm a great choice for computationally demanding optimization tasks like the bootstrapped estimation of nonlinear model parameters and their sampling distributions. In a case study, EAGO is used to estimate the parameter variabilities of a social-psychological behavior model and a variance-based global sensitivity analysis and its implications are presented.

4 - Mission based component test plans

M. Emre Keskin, Industrial Engineering Department, Bogazici University, Rumelihisarustu Bebek, Istanbul,
34337, Istanbul, Turkey, emre.keskin@boun.edu.tr, I. Kuban Altinel, Suleyman Ozekci, Bora Cekay, Orhan Feyzioglu

System based component testing idea is applied many times in the literature. However, realizability definition employed in all these studies assumes a fixed time during which the object works without a failure. This realizability definition is invalid for systems designed to perform sequence of missions which are possibly in random order and have possibly random durations. In this study, a new method which we call as mission based component test plans is proposed for determination of the optimum component test plans for series systems and serial connection of redundant subsystems.

MD-19
Monday 13:35-14:55
Haber

Quasidifferential Analysis and Generalized Convexity

Stream: Convex Optimization 1

Invited session

Chair: Ryszard Urbanski, Faculty of Mathematics and Computer Science, Adam Mickiewicz University, Poznan, ul. Umultowska 87, PL-61-614, Poznan, Poland, rich@amu.edu.pl

Chair: Diethard Pallaschke, Statistics and Mathematical Economics, University of Karlsruhe, Kaiserstr. 12, Geb. 11.40, D-76128, Karlsruhe, Germany, lh09@rz.uni-karlsruhe.de

1 - Quasidifferentiable functions and pairs of compact convex sets

Diethard Pallaschke, Statistics and Mathematical Economics, University of Karlsruhe, Kaiserstr. 12, Geb. 11.40, D-76128, Karlsruhe, Germany, lh09@rz.uni-karlsruhe.de, Ryszard Urbanski

Pairs of compact convex sets arise in the quasidifferential calculus of V.F. Demyanov and A.M. Rubinov as sub- and superdifferentials of quasidifferential functions. Of importance are minimal elements. Different criteria for minimality are presented. Algebraic and geometric characterizations of minimality lead to a separation law of convex sets by sets.

The equivalence of the separation law with the order cancellation law will be shown. Within the frame of a commutative ordered semigroups with cancellation law pairs of convex sets lead to a fractional arithmetic for convex sets.

2 - Gradient set splitting in nonconvex nonsmooth numerical optimization

Enrico Gorgone, DEIS, University of Calabria, Via Pietro Bucci, CUBO 41c, 87036, RENDE, Italy, egorgone@deis.unical.it

We classify the limit points of gradient sequences, for a locally Lipschitz function, on the basis of the linearization error with respect to a given point. Thus we construct two distinct polyhedral approximations of the objective function, which are used in the definition of two quadratic subproblems. We design a bundle type algorithm based on alternate solution of such subproblems. We prove termination of the algorithm under the hypothesis that the function is weakly semismooth. The results of some numerical experiments are also reported.

3 - Conically equivalent convex sets and applications

Alberto Zaffaroni, Dipartimento di Scienze Economiche e Matematico-Statistiche, Universita’ di LECCE, Centro Ecotekene - via Monteroni, 73100, LECCE, Italy, aza@economia.unile.it

Given a l.s.c. sublinear function $h$ on a normed space $X$ and a cone $K$ in $X$, two closed, convex sets $A$ and $B$ in $X$ are $K$-equivalent if their support functions coincide on $K$. We characterize the greatest set in an equivalence class, the equivalence between two sets, and find conditions for the existence and the uniqueness of a minimal set. We give some applications to the study of gauges of convex radiant sets and of cagonges of convex corandant sets. Moreover we study the minimalty of a second order hypodifferential.

MD-20
Monday 13:35-14:55
Mann

DEA Methodology 1

Stream: DEA and Performance Measurement

Invited session

Chair: Luka Neralic, Faculty of Economics & Business, University of Zagreb, Trg J. F. Kennedy 6, 10000, Zagreb, Croatia, lneralic@efzg.hr

1 - Sensitivity in data envelopment analysis using an approximate inverse matrix

Luka Neralic, Faculty of Economics & Business, University of Zagreb, Trg J. F. Kennedy 6, 10000, Zagreb, Croatia, lneralic@efzg.hr, Richard E. Wendell

In this paper, sensitivity analysis of the Charnes-Cooper-Rhodes (CCR) model in data envelopment analysis (DEA) is studied for the case of perturbation of all outputs and of all inputs of an efficient decision making unit (DMU). Using an approximate inverse of the perturbed optimum basis matrix, an approximate preservation of efficiency for an efficient DMU under these perturbations is considered. Sufficient conditions for an efficient DMU to preserve its efficiency are obtained in that case. An illustrative example is provided.

2 - Rational inefficiencies of stochastic service productions

Andreas Kleine, Institute of Business Administration, University of Hohenheim (510A), D-70593, Stuttgart, Germany, ankleine@uni-hohenheim.de

We analyze service productions which are characterized by a stochastic external factor and choose data envelopment analysis as the basis for our methodology. Preference relations between inputs and outputs are derived from observed production data. Using this information we introduce a modified concept of value efficiency. We illustrate that depending on the assumed probabilities a value inefficient DMU can be stochastically efficient. Hence, a DEA inefficiency is not necessarily contradictory to rational behavior.

3 - Measurement and decomposition of Malmquist productivity index under variable capacity utilization

Giannis Karagiannis, economics, university of macedonia, 156 egnatia str., 54006, thessaloniki, Greece, karagian@uom.gr, Panos Fousekis
The aim of the paper is to obtain a decomposition of the Malmquist productivity index under variable capacity utilization. This is pursued using DEA and the bottom-up approach, suggested by Balk (2001). By measuring technical efficiency relative to the short-run (variable-return-to-scale) frontier we develop two alternative decompositions of the Malmquist productivity index based on two alternative notions of technical change: that defined relative to the capacity frontier (benchmark technology) and that defined relative to the best practice frontier.

### MD-21
Monday 13:35-14:55
Hauptmann

**Models for Screening and Medical Decision Making**

**Stream:** Health Care Management  
**Invited session**

**Chair:** Elena Rizzato, Paediatrics, University of Padova, Via Dona’ 11, 35129, Padova, Italy, ele.rizzato@unipd.it

1. **When to recommend biopsy to women undergoing mammography screening? a Markov decision process (mdp) model**  
Oguzhan Alagöz, Department of Industrial and Systems Engineering, University of Wisconsin-Madison, 1513 University Avenue, 53706, Madison, WI, United States, alagoez@engr.wisc.edu, Jaggreet Chhatwal, Elizabeth Burns

Early diagnosis through screening mammography is the most effective means of decreasing the death rate from breast cancer. If a mammogram reports a suspicious finding, then a biopsy is required to decide whether an abnormality is in fact a cancer. Breast biopsy delivers a benign result in 55-85% of cases, resulting in extra anxiety for the patients and unnecessary treatments. We use Markov Decision Processes (MDP) to optimize the biopsy decisions for a woman while maximizing her total expected quality-adjusted life-years. Our results show that optimal biopsy decisions should be age-dependent.

2. **Admission control for preventive services**  
Derya Kunduçu, Koç University Rumelihifeneri Yolu SARIYER, 34450, ISTANBUL, Turkey, dkunducu@gmail.com, E. Lerzan Ormeci, Evrim Didem Gunes

We consider the capacity rationing of colonoscopy within patients coming from different risk groups, the highest risk corresponding to colorectal-cancer patients. The system can exercise admission or scheduling and both controls. Scheduling lower risk patients is to colorectal-cancer patients. The system can exercise admission coming from different risk groups, the highest risk corresponding to colorectal-cancer patients. The system can exercise admission or scheduling or both controls. Scheduling lower risk patients is to colorectal-cancer patients. The system can exercise admission coming from different risk groups, the highest risk corresponding.

3. **Modelling trauma hip fracture hospital activities**  
Cheryl Voake, Cardiff School of Mathematics, CF24 4AG, Cardiff, vouake@cf.ac.uk, Jeff Griffiths, Janet Williams

Hip fractures are becoming an increasing problem in hospitals due to the ageing population. The effects of a delay to operation on mortality and length of stay are investigated. A simulation model is being built to model the flow of admissions of trauma hip fracture patients through a large teaching hospital. It was an additional requirement of the hospital that they could focus particularly on a patient’s journey through theatre. A number of what-if situations are considered. Future ideas are discussed, including the theoretical formulation of the theatre process.

### MD-22
Monday 13:35-14:55
Arndt

**Optimization Modeling in Practice II**

**Stream:** OR Applications in Industry  
**Invited session**

**Chair:** Eleni Pratsini, IBM Zurich Research Lab, Saeumerstrasse 4, 8803, Zurich, Switzerland, pr@zurich.ibm.com

**Chair:** Bjarni Kristjansson, Maximal Software, Ltd., Boundary House, Boston Road, W7 2QE, London, Iceland, bjarni@maximalsoftware.com

1. **Practical solutions in network design for dhl**  
Hans Schut, DHL Supply Chain, Bundeskanzlerplatz 2-10 (Bonn Center), 53113, Bonn, Germany, hans.schut@dhl.com, Sander van den Berg

DHL Supply Chain deals with many challenges in Supply Chain Planning. The scope of the presentation will be on Outbound Distribution. From an OR perspective this can be subdivided in Assignment, Min Cost Flow and Route planning problems and integrality is imposed on the variables. The combination of size and integrality make it difficult to find an optimum and solve the problems in a reasonable time. DHL found practical methods that combine best of both worlds. The presentation includes several real world problems from the technology and automotive industry.

2. **Mathematical programming based strategic and tactical production and operational logistics planning in the automotive industry**  
Achim Koberstein, Decision Support & OR Lab, University of Paderborn, Warburger Str. 100, 33098, Paderborn, Germany, koberstein@dсор.de, Leena Stuhl, Ralf Bihlmaier, Thomas Sillekens, Jens Peter Kempees, Thomas Sommer-Dittrich

In this talk we give an overview over three optimisation systems for planning problems faced by the automotive industry, namely, strategic production planning, tactical workforce planning and operational logistics planning. For the strategic problem we developed a two-stage stochastic mixed-integer programming model, which is solved by an accelerated Benders’ decomposition method. The workforce and logistics planning problems are modeled as mixed-integer linear programming problems and solved by standard solvers and heuristics.

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**EURO 23 - Bonn 2009**

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3 - Collaborative production optimization in plantwide production scheduling and planning

Guido Sand, Corporate Research Germany, ABB AG, Wallstatter Straße 59, 68526, Ladenburg, Germany, guido.sand@de.abb.com, Xu Chaojun

In today’s processing industry, various optimization based decision and automation functions are implemented and used in APC (advanced process control), APS (advanced planning and scheduling), energy trading and the like. Often, distinct subsystems of a plant are optimized in a decentralized manner lacking a function for collaborative optimization of the entire plant. Based on a use case from the metals industries, we discuss the potential of collaborative schedule optimization and a generic solution approach.

4 - Alignment of replenishment and lateral transshipment decisions in spare parts networks

Harold Tiemessen, Mathematical and Computational Sciences, IBM Research, Sauenerstrasse 4, CH-8803, Rueschlikon, Switzerland, hti@zurich.ibm.com, Eleni Pratsini, Moritz Fleischmann

We consider the problem of joint replenishment and lateral transshipment decisions in a single-echelon inventory network. Under a general setting we develop a framework for the alignment of the two decisions and investigate the possible benefits of jointly optimizing them. Furthermore, for a system of service level constraints, we develop a replenishment rule that provides a lower bound on total inventory holding costs over all possible transshipment policies. We discuss the computational challenges faced and the managerial implications. The work is motivated by IBM’s spare parts network.

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**Solution Methods for Semi-Infinite Optimization**

**Stream: Semi-Infinite Optimization**

**Invited session**

Chair: Alexander Mitsos, Mechanical Engineering, Massachusetts Institute of Technology, 77 Massachusetts Avenue, MIT 3-158, 02139, Cambridge, MA, mitsos@mit.edu

1 - Right-hand side restriction for the deterministic global optimization of semi-infinite programs

Alexander Mitsos, Mechanical Engineering, Massachusetts Institute of Technology, 77 Massachusetts Avenue, MIT 3-158, 02139, Cambridge, MA, mitsos@mit.edu

A deterministic algorithm is proposed for the global solution of SIPs without any convexity/concavity assumptions. The only assumptions are continuity of the functions and existence of an epsilon-optimal SIP Slater point. A converging upper bounding procedure is proposed based on a restriction of the right-hand-side of the constraint and a discretization of the parameter set. The converging lower bound is obtained by successively tighter discretization. The algorithm is extremely simple to implement and yet very efficient compared to existing methods, as demonstrated by numerical examples.

2 - Bi-criteria multi-body design centering in presence of guillotine constraints

Jan Schwientek, Optimization, Fraunhofer ITWM, Fraunhofer-Platz 1, 67663, Kaiserslautern, Rhineland-Palatinate, Germany, Jan.Schwientek@itwm.fraunhofer.de, Karl-Heinz Küfer, Anton Winterfeld
Multi-body design centering (MBDC) deals with the optimal embedding of several parametrized bodies (the designs) into another body (the container). Naturally, the designs are required to be non-overlapping, but in practice it is often necessary, that they can be separated by a sequence of guillotine cuts. In our problem, two objectives have to be considered, and the guillotine patterns aren’t restricted to orthogonal ones. We formulate bi-criteria MBDC problems with guillotine constraints in a semi-infinite way and present first numerical results for a practical problem with few designs.

3 - Semi-infinite optimization with implicit functions
Matthew Stuber, Department of Chemical Engineering, MIT, 77 Massachusetts Ave., Bldg 66-363, 02139, Cambridge, MA, United States, stuber@mit.edu, Paul I. Barton

A method for globally solving nonlinear nonconvex semi-infinite optimization problems constrained by implicit functions using interval methods is presented. Implicit functions arise when the infinite inequality constraint in an SIP is dependent not only on the index variables and decision variables, but also on variables that are implicit functions of the index and decision variables. Using interval methods, convex relaxations of the implicit infinite inequality constraint are calculated and refined in the Branch-and-Bound framework allowing for the calculation of global optima.

The present article offers a technique to construct extensions of the Shapley value for TU games. Only basic matrix algebra is used. We define an efficient Aumann-Dreze value and an efficient Myerson value. We also define two families of values, the first being a convex combination of the efficient Aumann-Dreze value and of the Shapley value and the second a convex combination of the efficient Myerson value and of the Shapley value. We show that the Myerson value, the Aumann-Dreze value, the Shapley value and the four new solutions above are linked by a relationship of “similarity”.

3 - Möbius inversion of cooperative games involving partitions of players
Giovanni Rossi, Computer Science, University of Bologna, Mura Anteo Zamboni 7, 40126, Bologna, roxyjean@gmail.com

Cooperative games involving partitions of players are (1) games in partition function form PFF, (2) global G games, (3) global coalition GC games. Möbius inversion is used for analyzing them in terms of both solutions and cooperation restrictions. A solution of any cooperative game, regarded as a function taking real values on an atomic lattice, is defined as a cooperative game of the same type (i.e. taking values on the same lattice elements as the game to be solved) and with Möbius inversion living only on atoms. The implications are discussed for G, GC and PFF games.
In this talk we present results of an ongoing study, based on a problem of a textile factory. The core problem is an integrated lotsizing and scheduling one, characterized by sets of parallel machines, arbitrary demands and due dates for products, a compatibility matrix between machines and components and release dates of machines.

In a solution, the quantities to produce by product/component/size are split among smaller lots, the machines in which those lots will be produced are determined, as well as the order in which they will be done. We present a MIP model and results of a VNS heuristic.

3 - Dynamic uncapacitated lot sizing with random demand under a filament constraint

Horst Tempelmeier, Supply Chain Management and Production, University of Cologne, Albertus-Magnus-Platz, D-50923, Cologne, Germany, tempelmeier@wiso.uni-koeln.de, Sascha Herpers

This paper deals with the single-item dynamic uncapacitated lot sizing problem with random demand. We propose a model based on the "static uncertainty" strategy. In contrast to these authors, we use exact expressions for the inventory costs and we apply a filament constraint. We present an exact solution method and modify several well-known dynamic lot sizing heuristics such that they can be applied for the case of dynamic stochastic demands. The results of a numerical test of the heuristics are shown.

3A-33, 1081 HV, Amsterdam, Netherlands, kroodbergen@rsm.nl

3 - Scheduling of container storage and retrieval

Kees Jan Roodbergen, Erasmus University, Rotterdam School of Management, P.O. Box 1738, 3000 DR, Rotterdam, Netherlands, kroodbergen@rsm.nl

We consider the problem of scheduling the storage and retrieval of containers in the stack. Some arcs in the underlying directed network must be visited; other arcs may - but need not be - visited. We can consider this problem to be a special case of the directed Rural Postman Problem. We show that this problem can be reformulated as an asymmetric Steiner Traveling Salesman Problem which can be efficiently solved to optimality by a combination of optimal assignments in bipartite networks for parts of the problem and dynamic programming for the connections between those parts.

3A-33, 1081 HV, Amsterdam, Netherlands, kroodbergen@rsm.nl

4 - Routing multiple automated stacking cranes at container terminals

Iris E.A. Vis, Faculty of Economics and Business Administration, Vrije Universiteit Amsterdam, De Boelelaan 1105, 1081 HV, Amsterdam, Netherlands, ivis@feweb.vu.nl, Hector Carlo

The significant growth in volumes of containers being transshipped puts a strain on all logistics processes at container terminals, including the stacking processes. This study is concerned with scheduling storage and retrieval requests for two Automated Stacking Cranes operating in the same block. We present a mathematical model to minimize the makespan for both cranes. Both an algorithm to derive a lower bound for the makespan and a simulated annealing based heuristic are proposed to efficiently solve the problem.

3A-33, 1081 HV, Amsterdam, Netherlands, kroodbergen@rsm.nl
Changes in interest rate have an impact on a household's mortgage payments and house price fluctuations influence the ability to repay the outstanding debt. The household is interested in minimizing the mortgage payments and reduce the probability of insolvency. We introduce stochastic programming models which explicitly account for interest rate and house price risk. We show that a portfolio of a Danish type fixed rate mortgage and a variable rate mortgage offers cheap house financing and hedge against insolvency in markets with the risk of increasing interest rates and falling house prices.

We consider the problem of constructing a portfolio, which is non-dominated with respect to second order stochastic dominance and thus optimal for risk-averse investors. In addition, this portfolio has a return distribution close to a user-specified, target distribution. The model is formulated as a multi-objective CVaR minimization problem and represented as a LP of large size. Further on, a cutting plane representation of CVaR is used. This approach dramatically increases the execution speed and makes the model solvable even for very large number of scenarios.

We propose a stochastic programming model to select portfolios of bonds, where the aim of the decision maker is to minimize the cost of the decision process. At the same time, we bound the conditional Value-at-Risk, a measure of risk which accounts for the losses of the tail distribution.

We introduce stochastic programming models which explicitly account for interest rate and house price risk. We show that a portfolio of a Danish type fixed rate mortgage and a variable rate mortgage offers cheap house financing and hedge against insolvency in markets with the risk of increasing interest rates and falling house prices.

We consider the problem of constructing a portfolio, which is non-dominated with respect to second order stochastic dominance and thus optimal for risk-averse investors. In addition, this portfolio has a return distribution close to a user-specified, target distribution. The model is formulated as a multi-objective CVaR minimization problem and represented as a LP of large size. Further on, a cutting plane representation of CVaR is used. This approach dramatically increases the execution speed and makes the model solvable even for very large number of scenarios.

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For controlling a Markov decision process (MDP) it can be useful if control actions do not depend on the current state of the dynamical system. For example if the MDP is too large and complex to obtain an (optimal) state-dependent control policy by established methods like dynamic programming or if it is a burden to observe the current system state. Also a state-independent policy is easier to implement. Both randomized and deterministic state-independent control policies are considered discussing their advantages, disadvantages and methods for optimization.

2 - Optimization of power plant investments using approximate dynamic programming

Ansgar Geiger, Optimization, Fraunhofer Institute for Industrial Mathematics, Fraunhofer Platz 1, 67663, Kaiserslautern, Germany, ansgar.geiger@itwm.fraunhofer.de, Stefan Nickel

In power generation expansion planning, two decisions must be made: the technology choice and the timing of the investments. These decisions are strongly influenced by uncertain fuel and emission allowances prices. We formulate the investment problem as a stochastic dynamic model. To be able to consider the effects of the new units on the electricity market, the investment model is coupled with a simple electricity market model determining the electricity prices. Two solution approaches are presented and compared: dynamic programming using aggregation and approximate dynamic programming.

3 - Inventory rationing and sharing for traveling salesmen

Grigory Pishchulov, Chair of Industrial Management, European University Viadrina, Grosse Scharrnstr. 59, 15230, Frankfurt (Oder), Germany, pishulov@euw-frankfurt-o.de

The paper focuses on stock control in pre-sell distribution which engages traveling salesmen to reveal customer demands and quote deliveries. A model company is considered whose salesmen may ration the stock when meeting the demand. The optimal rationing problem is stated as a multi-stage stochastic program. The capability of mobile communication is shown to benefit the company by enabling stock sharing between sales territories and information sharing when demands are dependent. Stochastic dynamic programming is utilised to determine control policies and establish their structural properties.

4 - Learning and forgetting in setups:

Sunantha Teyarachakul, Operations Management, ESSEC Business School, Avenue Bernard Hirsch B.P. 50105, 95021, Cergy-Pontoise Cedex, teyarachakul@essec.fr

We consider the impacts of learning and forgetting in setups on batch-sizing decisions. A dynamic programming algorithm to obtain the optimal production schedule is developed and presented. We have found several properties associated with our model. For example, Zero-Inventory Property satisfies the optimal policy. Our study demonstrates the situation where firms may be better off producing in smaller batches. This is a new insight that provides one more justification for producing in small lots.

MD-31

Monday 13:35-14:55
GS1 - S 34

Data Mining Algorithms for Quality Improvement

Stream: Data Mining in Quality Improvement

Invited session

Chair: Inci Batmaz, Statistics, Middle East Technical University, Middle East Technical University, Department of Statistics, 6531, Ankara, Turkey, ibatmaz@metu.edu.tr

1 - Design parameter optimization using mahalanobis Taguchi system

Baris Yenidunya, Eskisehir Yolu 4. Km. 2. Cadde No:63 C Blok Sogutuzi, 06520, Ankara, Turkey, barisyenidunya@gmail.com, Gulser Koksal

Mahalanobis Taguchi System (MTS) is a classification method developed mainly for diagnosis/pattern recognition problems. In this study, MTS is used for design parameter optimization problems with binary response. The proposed method is applied on two different cases and the results are compared to optimization results of the corresponding logistic regression models. Advantages and disadvantages of the approach are discussed.

2 - A nonparametric improved fuzzy classifier function approach for classification based on customer satisfaction survey data

Gizem Ozer, Bascavus street No:477 Kucukesat, 06660, Ankara, Turkey, gizem1306@gmail.com, Tuna Kilic, Elcin Kartal, Inci Batmaz, Ozlem Turker, Bayrak, Gulser Koksal, Burhan Turkson

Fuzzy Classifier Functions (FCF) and Improved FCF (IFCF) are newly developed methods used for classification problems to capture the effect of fuzzy uncertainty. These methods depend on construction of one classifier for each cluster after partitioning data with fuzzy c-means (FCM) and improved fuzzy clustering (IFC) methods for FCF and IFCF, respectively. To overcome fitting problems in IFC, we propose using a non-parametric method, MARS. In this study, FCF and IFCF are applied for building a classification model based on customer satisfaction survey data and their performances are discussed.

3 - On rough-set based multicriteria decision making in quality improvement

Guven Arslan, Statistics and Computer Science, Baskent University, Baglica Kamp., Faculty of Science and Letters, Eskisehir Yolu 20. Km, 06810, Ankara, Turkey, guvenca@baskent.edu.tr, Ozlem Aydin

The initial stage is probably one of the most difficult steps in applications of quality improvement problems. Usually it is not known in advance which variables and factors are most important. In such situations the use of data mining approaches are choices of researchers. It is known that rough sets can deal with inconsistencies effectively. Inconsistencies should also be expected in examples and measurements of quality problems. In this study the use of rough sets and MCDM in quality improvement is investigated and the results are discussed.

4 - Multi-class mts classification algorithms and their applications

Dilber Ayhan, Industrial Engineering Department, Middle East Technical University, Meksika Cad. 386.sok. Kardelen Sit. B lok. No:1, Umitkoy, Ankara, Turkey, dilber.ayhan@gmail.com, Gulser Koksal
In this study a classification algorithm, Weighted Multi-Class Mahalanobis Taguchi System (WMMTS), is developed. The motivation comes from Wolfel and Ekenel (2005), which relax adding up of Mahalanobis distances for variables equally. This provides representations of noisy variables with weights close to zero. Second, the classical MTS method is extended for multi-class problems, namely MMTS. Third, the approach of Su and Hasao (2009), feature weighted multi-class MTS (FWMMTS), is also modified. The FWMMTS is applied on several datasets, and its performance is compared to those of MMTS and FWMMTS.

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### MD-32

**Monday 13:35-14:55**  
**GS1 - S 4**  
**Financial Crisis**  
**Contributed session**  

**Chair:** M Shahid Ebrahim, Business School, University of Nottingham, Jubilee Campus, Wollaton Road, NG8 1BB, Nottingham, m.shahid.ebrahim@nottingham.ac.uk

1 - **Empirical study on stability of Japanese corporate ratings with artificial neural network**  
Katsuki Tanaka, Faculty of Business Administration and Information, Setsunan univ., 17-8 Ikadanakamachi, 572-8508, Neyagawa, Osaka, Japan, k-tanaka@kjo.setsunan.ac.jp, Motohiro Hagiwara, Hideki Katsuma, Susumu Saito

In Japan, investors have begun to use corporate ratings given by 4 major rating agencies as an index to measure the credit risk of each company. Corporate ratings are based on the quantitative data and qualitative information. But investors do not know the evaluation process or structure of rating agencies. In this paper, using artificial neural network, we propose the method to evaluate the determinant structure of corporate ratings given by agencies and their over-time stability. In our analysis, we only make use of the quantitative data of Japanese companies from the year 2001 to 2007.

2 - **The reasons us financial secretary paoon gave up lehman brothers from the non-american investors’ view**  
George Chun Ming Chien., Ph. D Student of Graduate Institute of Management Sciences,Agricultural Bank of Taiwan Department of Finance, Tamkang University, 151 Ying-Chuan Rd., 25137, Tamsui,Taipei, Taiwan, chingya816@yahoo.com.tw, Ching Ya Hsiao, Horng Jinh Chang

The investment banks are the major targets for fail because they do not have the deposit business. The fifth investment bank at US, Bear Stearns, was acquired by JP Morgan at 2007. The fourth investment bank, Lehman Brothers, filed chapter 11 at 2008 when the US government denied the same terms like Bear Stearns to the possible bidder. If the ratio of non-American Lehman Brothers bond holders is bigger than that of Bear Stearns, the article can conclude Paulson shared the loss of US real estate with investors outside American through Lehman Brothers’ failure.

3 - **With japan experience, this financial crisis will last longer than expected**  
Ching Ya Hsiao, Ph. D Student of Graduate Institute of Management Sciences, Tamkang University, 151 Ying-Chuan Rd, 25137, Tamsui,Taipei, Taiwan, ya816@yahoo.com.tw, George Chun Ming Chien., Horng Jinh Chang

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### MD-33

**Monday 13:35-14:55**  
**GS1 - S 7**  
**Metaheuristics in Global Optimization**  
**Invited session**  

**Chair:** Pilar Ortigosa, Computer Architecture and Electronics, Universidad de Almería, Ctra. Sacramento s/n, La Cañada de San Urbano, 04120, Almería, Spain, ortigosa@ual.es

1 - **Scheduling optimization based on a genetic algorithm under constraints**  
Djamil Boukredara, Laboratoire LIRE, University of Constantine, Route d’ Ain El Bey, 25000, Constantine, Algeria, boukredara@hotmail.com, Rabah Kassa, Khated Sellami

We focus on the scheduling problem in a virtual enterprise modeled by a autonomous agents whose aim is to improve their profitabil- ity while minimizing the customer’s service costs. The sales agents have to establish an optimal scheduling of customer’s orders. This can be formulated as a constraint satisfaction problem. We suggest an optimization method of the CSP based on the genetic algorithm. This hybridization aim at better taking over of this kind of problem which is defined by a large research space and a complex constraint set and finds solutions of good quality.

2 - **Determining optimal batch sizes by means of evolutionary algorithms and queueing network analysis**  
Boualem Rabta, Entreprise Institute, University of Neuchatel, Rue A.L. Breguet 1, 2000, Neuchatel, Switzerland, boualem.rabta@unine.ch

Batch sizes have a considerable impact on performance of a manufacturing process. Determining optimal values for lot sizes helps reducing inventories/costs and leadtimes. We model the manufacturing system as a GI/GI/1 batch arrivals queueing network. We use a genetic algorithm that searches for the optimal values for lot sizes and uses an approximate queueing network analysis procedure based on decomposition to evaluate the fitness of each population individual. This approach allows taking into account the randomness of different variables and provides fast and good solutions.
3 - A shared memory programming approach of uego.

Juanita Lopez-Redondo, Computer Architecture and Electronics, University of Almería, Carretera de Sacramento S/N, La Cañada de San Urbano, 04120, Almería, Spain, juanita@ace.ua.es, I. Garcia, Pilar Ortigosa

In this work, we deal with UEGO, a multimodal evolutionary global optimization algorithm. It has proved its ability at finding a global optimum solution in a variety of problems. Several parallel implementations of UEGO have been designed for distributed memory architectures with successful results. They were based on message-passing mechanisms. However, since new multicore systems are expected to become common as personal computers, it is advisable to adapt UEGO following shared memory programming. We analyze up to which extend UEGO takes advantages of shared memory architectures.

MD-34
Monday 13:35-14:55
GSI - S 8

Fuzzy Logic based decision systems
Stream: Fuzzy Systems, Neural Networks & Artificial Intelligence

Fuzzy rule based scenario-management
Thomas Spengler, Department of Economics and Management, Otto-von-Guericke-University Magdeburg, P.O. Box 4120, 39016 Magdeburg, 39016, Magdeburg, thomas.spengler@ovgu.de

Against the background of increasing environmental complexity, contingency and dynamics scenario management is highly important. Due to the corresponding vagueness and fuzziness the current procedures of the scenario toolbox are no appropriate instruments to treat the judgements and opinions of experts. Therefore we recommend the modelling of fuzzy procedures in the scope of influence, consistency and cross-impact analysis. Hence, we get the ability to treat the estimations and evaluations in a realistic manner. The corresponding procedures are based on fuzzy rule systems.

2 - Does the law of large numbers hold if people estimate the mean of a random variable by observing it for several times? —an example of fuzziness in the responses of people

Bodo Vogt, Fakultät für Wirtschaftswissenschaft, Otto-von-Guericke-Universität Magdeburg, Postfach 4120, 39016 Magdeburg, Germany, bodo.vogt@ww.uni-magdeburg.de, Thomas Spengler

According to statistics observing the realizations of a random variable several times enables an individual to estimate the mean of the random variable more precisely. The variance of the estimator should decrease. In an experiment we test this by asking individuals for confidence intervals of their estimates after different numbers of observations. The confidence interval does not decrease after few observations indicating an uncertainty that is not described by the classical statistical model. We use fuzzy theory to describe this phenomenon and connect our model to behavioral economics.

3 - On the development of a risk-model using credibilistic processes
Masayuki Kageyama, The Institute of Statistical Mathematics, 4-6-7 Minami-Azabu, Minato-ku, 106-8569, Tokyo, kageyama@ism.ac.jp

In a talk we propose a new risk model to find out a threshold credibility measure. The idea of credibility measure, was introduced by Professor Liu in order to measure fuzzy event, which provides a powerful tool for analysis of the real uncertain problem. At first we introduce how to construct credibilistic processes which is our previous work and play a key role in our model and discuss our proposed risk model. Also, we give a numerical example.

MD-35
Monday 13:35-14:55
GSI - S 9

Facilitated Strategy Making
Stream: Facilitated Modelling Interventions
Invited session

Chair: Colin Eden, University of Strathclyde, United Kingdom, colin@mansci.strath.ac.uk
Chair: Fran Ackermann, University of Strathclyde, United Kingdom, fran@mansci.strath.ac.uk

1 - Anchoring decision analysis in the strategic management toolbox
Paul Schulze-Cleven, Department of Management, London School of Economics, Wollaston Str. 64, 10435, Berlin, Germany, p.j.schulze-cleven@lse.ac.uk, Gilberto Montibeller, Martin Schilling

A variety of tools are available to support the generation of strategy. However, decision analyses have not yet been analyzed as an element of strategy developing processes. In this talk I would like to derive a more outcome oriented understanding of Decision Analysis - stressing the claim and ability to impact organizational strategy and performance - and argue for its acknowledgment within strategic management. Departing from the genuine overlaps of the two fields I will map Decision Analysis methods against various established strategic management tools.

2 - ScriptsMap—a tool to facilitate design of strategy workshops
David Andersen, Public Administration and Policy, University at Albany, 1400 Washington Avenue, 12054, Albany, New York, United States, David.Andersen@albany.edu, Colin Eden, Fran Ackermann, George Richardson

This paper reports on the development of a tool to facilitate the design of workshops using system dynamics group model building, and group problem structuring with causal mapping and using a GSS. The paper explains both the genesis and purpose of 'ScriptsMap' as a means for articulating an extensive range of steps (scripts) useful when designing model building workshops. The map comprises 'building blocks' allowing a facilitator to construct, with the map's aid, a thoughtful and careful design. The paper will illustrate the ScriptMap’s structure through two example scripts.

3 - Modelling competitive advantage
Colin Eden, Management, University of Strathclyde, 199 Cathedral Street, G4 0QU, Glasgow, United Kingdom, colin@gsb.strath.ac.uk, Fran Ackermann
4 - Modelling the dynamics stakeholder reactions: a process for considering stakeholder responses, reactions and interactions when developing strategy

Fran Ackermann, Management Science, Strathclyde University, 40 George Street, G1 1QE, Glasgow, United Kingdom, fran.ackermann@strath.ac.uk, Colin Eden, David Andersen, George Richardson

Understanding the impact of stakeholder reactions to policy decisions is a critical part of ensuring the likelihood of success. The paper discusses a modelling process for eliciting key stakeholders’ interests, and sanctions or support activities. The process draws upon well-established research in stakeholder management, strategy, & systems thinking. The design explicitly considers interactions between stakeholders with a focus on developing dynamics. The outcome can inform the development of a system dynamics model by modelling feedback between the organization and their stakeholders.

In this talk we consider a dynamic risk measure for discrete-time payment processes. Analogous to the static AVaR, this risk measure can be reformulated in terms of a Markov decision problem. This observation gives a nice recursive computation formula. Then the dynamic risk measure is generalized to a setting with incomplete information about the risk distribution which can be seen as model ambiguity. We choose a parametric approach here. The risk measure is now the solution of a Bayesian decision problem. It is also possible to discuss the effect of model ambiguity on the risk measure.

3 - Portfolio optimization with dynamic risk constraints and partial information

Jörn Sass, Fachbereich Mathematik, TU Kaiserslautern, Postfach 3049, 67653, Kaiserslautern, Germany, sass@mathematik.uni-kl.de

An investor wants to maximize expected utility of terminal wealth. Stock returns are modeled as a SDE with non-constant coefficients. If the drift depends on a process independent of the driving Brownian motion, it may not be adapted to the filtration generated by the stock prices and has to be filtered from the observed prices. In such a model with partial information the optimal strategy can be very extreme. To reduce the shortfall risk, we impose dynamic risk constraints on the strategy. These lead to much more stable strategies which can be computed for classical drift models.

4 - Portfolio optimization under uncertain drift

Christoph Wopperer, Optimization & Operations Research, Ulm University, Helmholtzstrasse 22, Room E017, 89081, Ulm, wopperer@gmx.de

Classical portfolio optimization problems assume the availability of a fully characterized stochastic model. However, the mean rate of return of the stock price process is extremely difficult to estimate. Therefore it is desirable to take uncertainty about the return process into account. We discuss a worst-case approach to consumption-investment problems under an uncertain drift process. For the HARA utility function and stochastic coefficients of the stock price process we give a characterization of the robust optimal policy and the worst-case drift process by the solution of a linear BSDE.
We consider the problem of managing a fleet of trucks with different capacity to serve the transportation demand of a given quantity of goods from an origin to a destination at a given time. We propose a dynamic programming model. A linear programming version of the problem is also presented and its solution is exploited via revenue management techniques. Policies that incorporate the “truck sharing”, i.e., the joint use of the resource between certain customers are developed. Numerical experiment are carried out to compare the different policies.

2 - A branch and cut algorithm for the product assortment problem under customer choice behavior

Juan Jose Miranda Bront, Computer Science
Department, University of Buenos Aires, Av. Cantilo s/n, Pabellon I, Ciudad Autónoma de Buenos Aires, jmiranda@dc.uba.ar, Isabel Méndez-Díaz, Gustavo Vulcano, Paula Zabala

We consider a revenue management problem with fixed prices and a general model of market segmentation. Consumers within each segment choose according to a multinomial logit model. The seller has to decide the optimal set of products to offer in order to maximize the instantaneous revenue rate. We formulate the problem as a MIP and develop a branch-and-cut to solve it effectively. Our numerical experiments provide evidence of the potential of our approach.

3 - Robust pricing in the newsstand model

Guillaume Roels, Anderson School of Management,
UCLA, 110 Westwood Plaza, B511, 90095, Los Angeles, CA, groels@anderson.ucla.edu

It is usually assumed that firms who seek to optimize their prices have full knowledge of the price-demand curve. However, in practice, many firms are unwilling to experiment with price changes. In this talk, we consider the newsstand model with endogenous pricing and relax the traditional informational assumption about the price-demand curve. We design robust pricing strategies and quantify the value of information about the price-demand curve.

MD 38

Monday 13:35-14:55

Lean Accounting Beyond Operations

Stream: Lean Accounting

Invited session

Chair: Thomas Kristensen, Center for Industrial Production, Aalborg University, Fiiigerstrende 16, 9220, Aalborg Ø, thomas@lean-accounting.org

1 - Cost estimating for lean supply chains

Marcus Schweitzer, Fachbereich 5, University of Siegen, Hoelderlinstr. 3, 57076, Siegen, Germany, maschweitzer,sb@freenet.de

One major topic of lean management is the design of pull-driven supply chains, realized for example in a continuous replenishment system. This raises the questions of how the supply chain should be controlled and how performance indicators can be used. The article introduces a framework for the design of a lean performance measurement system.

2 - Adopting BSC as a change management tool in a public transport operator: the STCP case study

Leandro Carvalho, Department of Industrial Management, Faculty of Engineering of the University of Porto, Portugal, Rua 4 Caminhos, Vereda 2, n72, BL:B, 7F, Canidelo, 4400-260, Vila Nova de Gaia, Portugal, leandromec@yahoo.com.br, Jorge Freire de Sousa

This paper describes the case study of an adaptation of the Balanced Scorecard to the particularities of STCP, the main public transport operator in the city of Oporto. It will be used as a change management tool in order to communicating and clarifying the strategy of the company. The study proposes a new perspective, the value creation for the Stakeholder, as the prime strategic objective of the BSC, and based on this proposal, the STCP strategic map was developed. Concluding, the benefits obtained from the introduction of these tools in its strategic management system will be discussed.

3 - Standard costing in a lean organization: enabling OR coercive?

Thomas Kristensen, Center for Industrial Production, Aalborg University, Fiiigerstrende 16, 9220, Aalborg Ø, thomas@lean-accounting.org

Using the enabling-coercive dichotomy we find, in our case studies, that Standard Costing can be perceived as enabling by the actors of Lean companies. Hence, an enabling Standard Costing approach is found to fit Lean, thus contradicting that organic control fits Lean. We look into which uses of Standard Costing and variance analysis constitute the content of the four dimensions of enabling, i.e., repair, internal & global transparency and flexibility. These dimensions focus on the use of standard costing and not the technical structure of the costing models.

MD 39

Monday 13:35-14:55

Game Theory 3

Stream: Game Theory

Contributed session

Chair: Mariusz Kaleta, Institute of Control & Computation Engineering, Warsaw University of Technology, Nowowiejska 15/19, 00-665, Warsaw, mkaleta@ia.pw.edu.pl

1 - On optimal organization of government and corporate control

Alexander Vasin, Operations Research, Lomonosov Moscow State University, Russia, Moscow, Leninskii Gori, MSU, 2nd educational building, room 648, 119992, Moscow, Russian Federation, vasin@cs.msu.su

We consider several problems of optimal organization for revenue collecting and law enforcement inspections. We study whether it is possible to organize an effective control over 100000 agents and suppress corruption in case when very few reliable persons are available for this purpose. We determine the optimal strategy including selection of agents for the primary audit and revisons, salaries and premiums of inspectors at different levels, the number of levels in the hierarchy. We show that under general assumptions one honest person is enough for efficient inspection.

2 - Fuzzy subjective conflict analysis

Teruthisa Nakai, Civil, Environmental and Applied Systems Engineering, Kansai University, 3-3-35
Yamate, 564-8680, Suita, Osaka, Japan, nakai@iecs.kansai-u.ac.jp

For an analysis of a noncooperative game we propose a fuzzy subjective conflict analysis which applies a conflict analysis to a fuzzy subjective game reflecting a subjective sense of value of a player and fuzziness and nonadditivity in human judgments. We show that it is desirable for a player to use a strategy indicated by the stable equilibrium point having a maximum realization probability in his fuzzy subjective game. By this method we can explain the variety in selecting a strategy by a player and dispel the gap between the individual rationality and the social rationality.

3 - Decisiveness-related generalized class of power values for cooperative games

Dorota Marciniak, Polish Academy of Sciences, Warsaw, Poland, Dorotia@gmail.com

In the presentation I will introduce a class of power values for cooperative games with natural interpretation for simple games. This class contains new values with the properties of our interest. In particular new values that behave well for "oceanic games" considered by Shapley, for which it turns out that some established indices behave strongly counterintuitive. I will mention the property of this class which is more equal power distribution for more 'egalitarian' games.

4 - Computing α-efficient cost allocations

Mariusz Kaleta, Institute of Control & Computation Engineering, Warsaw University of Technology, Nowowiejska 15/19, 00-665, Warsaw, mkaleta@ia.pw.edu.pl

If a cooperative game modeling certain allocation problem has an empty core, then achieving an allocation free from subsidies, requires relaxing the condition for budget-balanced. We show, that the α-efficient allocation can be calculated by solving multicriteria linear programme. We use the concept of equitable rational preference relation to find the nondominated allocation fairly treating game players. However, the model suffers from the exponential number of constraints. To alleviate this drawback we apply the column generation method.

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**MD-40**

**Monday 13:35-14:55**

**GSI - S 27**

**OR Methods and Their Applications in Healthcare for Development**

**Stream: OR for Development and Developing Countries**

**Invited session**

Chair: Honora Smith, School of Mathematics, University of Southampton, Highfield, SO17 1BJ, Southampton, Hampshire, United Kingdom, honora.smith@soton.ac.uk

Chair: Gerhard-Wilhelm Weber, Institute of Applied Mathematics, Middle East Technical University, ODTÜ, 06531, Ankara, Turkey, gweber@metu.edu.tr

1 - Tackling maternal mortality: a mathematical model to help evaluate the impact of different interventions.

Christina Pagel, Clinical Operational Research Unit, University College London, 4 Taviton Street, WC1H 0BT, London, United Kingdom, c.pagel@ucl.ac.uk, Martin Uiley, Anthony Costello

Maternal mortality rates in sub-Saharan Africa have changed little since 1990. Two of the most common causes of maternal death are postpartum haemorrhage and puerperal sepsis. We developed a mathematical model to estimate the impact of three different strategies for reducing maternal deaths from haemorrhage or sepsis, using estimates of incidence, case fatality rates, availability and efficacy of treatment, and care utilisation by economic quantile. We found that interventions to improve community access to medical care could be a highly effective addition to health facility improvement.

2 - Modeling patient flows in a two-tier health service system

Evrin Didem Gunes, Operations and Information Systems, Koc University, Rumeli Feneri Yolu, 34450 , Istanbul, Turkey, egunes@ku.edu.tr, Mehmet Cagri Demiroglu

This work is motivated by the introduction of family practice in Turkey. The objective is to understand the expected changes in the behavior of patients and providers with the introduction of a gatekeeping system. System dynamics methodology is used to model patient flow in the health system, and to analyze the effect of introducing a gatekeeping system on the workloads for hospitals and for family doctors. Dynamics of service quality, word-of-mouth, referral rates, doctor’s salary contracts and number of available family doctors are investigated in different scenarios.

3 - Modelling the scalability of three different sized hospitals

Adisak Sakphisal, Faculty of Engineering and Industrial science, Swinburne University of Technology, 850/18 Soi Thunghthong, Thamuang, 71110, Kanchanburi, asakphisal@yahoo.com

In Thailand, a welfare agenda has been implemented mandating hospitals to treat patients without charge. Increasing demand for services has forced hospitals to grow rapidly without commensurate increase in funding. By decreasing waiting and treatment times, costs can be reduced, while increasing accessibility. To identify contributing factors, operational processes concerning patient flow were studied in hospital of varying size. Physical, information, and human resources relating to tasks performed were identified. The outcome is a planning model for reorganising outpatient departments.

4 - OR for sustainable community health programs in rural areas of developing countries

Honora Smith, School of Mathematics, University of Southampton, Highfield, SO17 1BJ, Southampton, Hampshire, United Kingdom, honora.smith@soton.ac.uk

Community health programs may be facilitated in rural regions of developing countries through village health workers (VHWs) or community centres (CCs). A scheme is being piloted in India as a means of providing the services of VHWs to areas where self-help groups (SHGs) are already functioning. The MNS mixed integer programming model finds best locations for a maximum number of VHW bases, depending on the density of SHGs in a target region. Additionally, dynamic growth in usage of a CC is modelled via a trust factor, where knowledge of the facility is spread by word of mouth.
MD-41

Monday 13:35-14:55
GSI - S 28

OR in Agriculture and Forest Management II

Stream: OR in Agriculture and Forest Management

Invited session

Chair: Yi-Ying Chen, 250, Kuo Kuang Rd., Taichung 402, Taiwan R.O.C., 402, Taichung, j75450@yahoo.com.tw

1 - Planning the harvest machinery use in a medium-size czech logging company

Jitka Janova, Department of Statistics and Operation Analysis, Mendel University of Agriculture and Forestry in Brno, Zemeldelska 1, 61300, Brno, Czech Republic, janova@mendelu.cz

The problem of tree harvesting planning in a medium size logging company in Czech Republic is treated. The mathematical programming model of the optimal utilisation of machine harvesters and manual operators, when minimum total costs are required, is designed based on the real cost characteristics of the machine and human resources. The impact of additional (environmental) restrictions—currently not fully taken into account by logging companies—is considered and the applicability of the model in the decision making of small and medium logging companies is discussed.

2 - Optimization of the use of biomass residues in the poplar plywood sector

Ivan Ferretti, Dipartimento di Ingegneria Meccanica, Università di Brescia, Via Branze 38, 25123, Brescia, Italy, ivan.ferretti@ing.unibs.it, Luca Zanchi

This research deals with the optimization of the use of biomass residues in an firm working in the poplar plywood sector. The residues are: bark, chips, sawdust and logs. Every residue is characterized by chemical composition, moisture content, lower calorific value and price. Price and moisture content change over time. The residues can be used for energy production, particleboard production and sale, otherwise stocked and subsequently used. The objective is the evaluation of the optimal quantities of biomass residues for the different uses in order to maximize the firm profit.

3 - Evaluating the pay-off of value chain retailer with agricultural products

Yi-Ying Chen, 250, Kuo Kuang Rd., Taichung 402, Taiwan R.O.C., 402, Taichung, j75450@yahoo.com.tw, Ming-Chih Tsai

This study aims to establish a decision model for evaluating food chain integration. Three integrations were identified for decision including transaction, partnering and strategic alliance. Customer value, termed as sale price and supply cost, calculated based on transaction cost theory are quantitatively compared. Parameters were calibrated from 105 real products. The results indicate that retailers’ deeper integration with suppliers may bring in a better profits, and vice versa. Short lived produce may significantly affect customer value; whereas, safety and stock-out cost affect supply.

MD-42

Monday 13:35-14:55
GSI - S 3

Health Care II

Stream: Health Care

Contributed session

Chair: Leonid Churilov, Statistics and Decision Support, National Stroke Research Institute, Neurosciences Bld, 300 Waterdale Rd, Austin Health, Repat Campus, 3083, Heidelberg Heights, VIC, Australia, leonid.churilov@gmail.com

1 - Fuzzy clustering employing wavelet coefficients for detection of mitral valve disorders

Necattin Barisci, Computer Eng., Kirikkale University, Kirikkale University, Dept of Computer Eng, 71450, Kirikkale, Turkey, nbarisci@hotmail.com

In this work, cardiac Doppler signals recorded from mitral valve of 75 patients were transferred to a personal computer by using a 16 bit sound card. Wavelet analysis was applied to the recorded signal from each patient and obtained wavelet coefficients. Further these coefficients were classified by using Fuzzy clustering algorithm. Our finding demonstrated that 96% correct classification rate was obtained from fuzzy clustering employing wavelet coefficients for classification of mitral valve disorders. Thus, an additional diagnosis tool is developed for the aid of expert medical staff.

2 - Is integrated care a solution to health care problems? on redesigning antenatal care processes with computer simulation.

Angele Pieters, Information Management, Tilburg University, Warandelaan 2, 5000 LE, Tilburg, angel.e.pieters@uvt.nl, Henk Akkermans

Costs and performance of the obstetric care system are subject to debate. This design research addresses two research questions: What are the organizational root causes of these problems? And, how can its performance be improved? Dutch obstetric care is organised as a focused factory, but does not perform accordingly. This research tests the concept of integrated care by system dynamic simulation, based on insights from disparate research fields and on insights from action research. This results in innovative insights in the antenatal care system and superior design principles can be defined.

3 - A new challenge: paediatric palliative care planning

Giorgio Romanin-Jacur, Management and Engineering, University of Padova, Stradella San Nicola, 3, 36100, Vicenza, Italy, romjac@dei.unipd.it, Giada Aspergh, Paola Facchin, Anna Ferrante, Laura Visona_Dalla_Pozza

A new patient class, recently considered for specific health care, includes small patients suffering for incurable pathologies. The suggested health care plan includes home care, interrupted by short admissions in an acute hospital department or in a specialized structure. The plan activation requires an assistance network based on the integration between specialized hospital resources and territorial generic medical and social ones. Models and simulations have been utilized to give right network dimensioning, with applications to an Italian region, easily extendable to other situations.

4 - Multi-attribute decision support for stroke imaging software selection

Leonid Churilov, Statistics and Decision Support, National Stroke Research Institute, Neurosciences Bld, 300 Waterdale Rd, Austin Health, Repat Campus, 3083, Heidelberg Heights, VIC, Australia,
Stoke is the second most common cause of death in the world. Acute ischemic stroke victims rely on thrombolysis as the only proven immediate intervention that markedly improve their clinical outcomes, while simultaneously presenting serious risks. Brain imaging plays pivotal role in identifying ischemic stroke patients with the potential to benefit most from thrombolysis. In this presentation we apply the Value-Focused Thinking principles and multi-attribute decision making techniques to the problem of selecting the most appropriate software for stroke imaging and patient selection.

MD-43

Forest Investments 2

Stream: Long Term Financial Decisions

Invited session

Chair: Thomas Knoke, Technische Universität München, 85354, Freising, Germany, knoke@forst.wzw.tum.de

1 - Financial analysis of andean alder (alnus acuminata h.b.k) under different scenarios of production “land use portfolio approach”

Baltazar Calvas, Institute of Forest Management, Technische Universität München, Am Hochanger 13, 85354, Freising, Bayern, Germany, calvas@forst.wzw.tum.de

The financial analysis of Andean alder under different scenarios of production will be helpful to find alternatives to maximize the income of farmers through reforestation in tropical “wastelands” in Southern Ecuador, at the surroundings of Podocarpus National Park. Seeking to reconcile the needs of farmer’s subsistence with the conservation needs of tropical forest, we investigated with the portfolio concept land use options for farmers.

2 - Loosing admixed tree species: financial consequences

Christian Clasen, Fachgebiet fuer Waldinventur und nachhaltige Nutzung, TU Muenchen, Am Hochanger 13, 85354, Freising, Germany, clasen@forst.wzw.tum.de

These days, the goals of forest management advance mixed forests. They seem to be more appropriate for sustainable thinking in many facets: Ecology, welfare and economics. Some aspects like game browsing advance the make/believe financial attractive tree species like spruce. But with including of probability of failure in earning rate of a long term stand life, mixed forests become more important. With the help of modern portfolio approaches, the loss of mixed species can be determined.

3 - Financial evaluation of mixed species plantations in southern chile

Patrick Hildebrandt, Fachgebiet fuer Waldinventur und nachhaltige Nutzung, TU Muenchen, Am Hochanger 13, 85354, Freising, Germany, hildebra@forst.wzw.tum.de

Mixtures of native and exotic tree species are emerging alternatives for afforestation of former agricultural areas in SouthernChile. The selection of optimum tree species proportions can be treated as a long term decision under uncertainty and can be evaluate financially with classical portfolio theory or other approaches. However, the results are quite sensitive to the applied optimization approach and the underlying data set.

4 - The value of expiring credits issued for carbon sequestration projects

Klaus Wallner, TU München, 85354, Freising, Germany, klaus.wallner@tum.de

We present a model to value expiring credits taking into account the regulatory constraints of the Kyoto Protocol. After outlining existing valuation models a new approach developed. Using a portfolio of options which duplicates the flow of payments triggered by an expiring credit as well as the immanent risks for buyers shows that future prices are not relevant for determining the price of an issued expiring credit. The value depends only on the current price of a permanent credit, the risk free return rate and the maturity of the expiring credits.

MD-44

Energy, Environment and System Optimization

Stream: Uncertainty and Environmental Decision Making

Invited session

Chair: Steven Gabriel, Civil & Env. Engin./ Applied Math and Scientific Computation Program, University of Maryland, 1143 Martin Hall, 20742, College Park, MD, United States, sgabriel@umd.edu

1 - Employing a two-level integer program for evaluating real options for low-carbon project selection under multi-stage competitions

Jeremy Eckhause, Civil and Environmental Engineering, University of Maryland, 2000 Corporate Ridge, 22102, McLean, Virginia, United States, jeckhause@lmi.org, Steven Gabriel

We formulate selection of low-carbon energy projects using a real options framework. We take the prospective of public-sector agency, whose objective is to determine the optimal funding strategies in order to achieve certain technological milestones. We develop a two-level integer program, where the upper level problem is the budget allocation and the lower level is the optimal funding strategy. We provide both numerical and theoretical results, describing the shape of this two-level problem and some results for efficient solution techniques.

2 - Analyzing energy security in natural gas markets

Steven Gabriel, Civil & Env. Engin./ Applied Math and Scientific Computation Program, University of Maryland, 1143 Martin Hall, 20742, College Park, MD, United States, sgabriel@umd.edu, Ruud Egging

In this paper, we provide an analysis of the North American natural gas market and by extension, impacts on Europe. We make use of the World Gas Model (WGM), a large-scale complementarity model of global gas markets in which some of the players are depicted as Nash-Cournot agents. WGM uses multiple years, players, and seasons to depict the operational and investment activity for worldwide gas markets. We consider a variety of supply scenarios including: gas from Alaska, additional shale production, LNG imports and competition in the Atlantic and Pacific basins.

3 - A discretely-constrained mathematical program with equilibrium constraints with an application in electric power markets

Florian Leuthold, Chair of Energy Economics and Public Management, Technische Universität Dresden,
Münchner Platz 3, Schumann Bau A 404, 01069, Dresden, Germany, Florian.Leuthold@tu-dresden.de, Steven Gabriel

In this paper we present a discretely-constrained mathematical program with equilibrium constraints (DC-MPEC) for European power markets. A Stackelberg leader determines generation levels while taking into account the actions of an Independent System Operator (ISO) and the competitive fringe. Since the overall problem is a bilinear program with complementarity and other constraints, we need to employ several approaches to convert it to a mixed-integer linear program. We provide results for a small three-node example as well as a larger 15-node problem for Western Europe.

MD-45

Monday 13:35-14:55
GSI - S 33

Activities for young people in OR

Stream: Young People for System Theory, Optimization and Education

Invited session

Chair: Alexis Pasichny, Students’ Science Association,
National Technical University of Ukraine “Kyiv Polytechnic Institute”, 37, Peremohy av., 03056, Kiev, Ukraine,
alexis.pasichny@gmail.com

Chair: Kateryna Pereverza, Students Science Association,
National Technical University of Ukraine, Kyiv,
Revutskogo, 19/1, app. 282, 02091, Kyiv, Ukraine,
pereverza.kate@gmail.com

1 - Theoretical and practical or problems for developing countries

Alexander Makarenko, Institute for Applied System Analysis, National Technical University of Ukraine “KPI”, Prospect Pobedy 37, 03056, Kiev, Ukraine, makalex@i.com.ua

In proposed talk we outline the vide spectrum of issues in OR from the general theoretical problems to the practical aspects. The main issues are: I. General OR problems for system of East/West countries II. OR science and practice as the subsystem of East/West system III. Some new OR research problems in considering developing countries IV. Presumable practical implementations of OR in developing countries V. The experience in OR field in Ukraine (AARIMS 2006-2009; EUROSCIENCE, NGO). Some concrete problems will be discussed in other talks of this subsection of conference.

2 - Education from inside: effective teaching methods from students’ viewpoint

Ielyzaveta Korotchenko, National Technical University of Ukraine “Kyiv Polytechnic Institute”, prospect Peremohy 37, 03056, Kyiv, Ukraine,
Korotchenko.liza@gmail.com, Kateryna Pereverza

The results of students’ survey held during the Summer school AACIMP are described in the paper. It was conducted to define the most effective, on students’ point of view, teaching methods and ways of presenting new material. The research consists of opinion survey among the participants of the Summer school and further analysis of the collected data. According to the results, there have been distinguished several teaching methods which are most accepted by students and ensure effective course learning. These methods can be successfully applied to education improvement in OR area.
Monday 15:20-16:10

ME-01
Monday 15:20-16:10
Maritim
Plenary 1
Stream: Plenaries
Plenary session
Chair: Benny Moldovanu, University of Bonn, 53113, Bonn, Germany, mold@uni-bonn.de

1 - Experimental results on the process of goal formation and aspiration adaptation
Reinhard Selten, Universität Bonn, 53113, Bonn, Germany, rselten@uni-bonn.de

We experimentally investigate how subjects deal with a multi-period planning and decision problem. The context is a profit maximization task in a computer-simulated monopoly market over fifty time periods. Subjects have to form vectors of goal variables. A goal variable is an arithmetic expression involving short term feedback variables like profit, sales or quality. An aspiration level is a vector of numerical values for the goal variables. The subjects are provided with a computerized planning tool allowing them to check feasibility of any aspiration level. We present results regarding, first, the selection of goal variables and, second, the process of aspiration adaptation. As to the first, we find that goal persistence, a measure of a subject’s tendency to stick to the current goal system, is strongly positively correlated with success. As to the second, we find that aspiration levels tend to be changed in strong agreement with basic principles of Aspiration Adaptation Theory (Sauermann and Selten 1962, Selten 1998, 2001). In addition, we find that in many cases the process of aspiration adaptation leads into a nearly stationary situation in which the aspiration level is approximately reproduced by a subject over several periods. Some subjects who reach a nearly stationary situation tend to be more successful and more goal persistent than those who do not. This is a joint work with Sabine Pittauer and Martin Hohnisch.

Monday 16:20-17:10

MF-01
Monday 16:20-17:10
Maritim
Plenary 2
Stream: Plenaries
Plenary session
Chair: Benny Moldovanu, University of Bonn, 53113, Bonn, Germany, mold@uni-bonn.de

1 - Computing equilibria
Christos Papadimitriou, EECS Department, University of California at Berkeley, 94720, Berkeley, CA, United States, christos@cs.berkeley.edu

The existence theorems establishing that certain equilibria, such as the mixed Nash equilibrium and price equilibria, are guaranteed to exist under very general conditions, are some of the most reassuring results in Economics. Developing efficient algorithms for computing these equilibria — that is, rendering these existence theorems constructive — has been over the past decades an important research front, which however has met with very limited success. In recent years, a new kind of complexity theory has been developed and applied to establish that certain of these computational problems are intractable, thus explaining the lack of progress in the development of efficient algorithms for them. These complexity results raise important new questions related to efficient algorithm for computing approximate equilibria, not unlike the way in which the theory of NP-completeness for combinatorial optimization problems in the 1970s led researchers to the exploration of approximation algorithms. In this talk I shall survey these complexity results, as well as a few recent algorithmic advances.
Metaheuristics and MIPs

Stream: Combinatorial Optimization

Invited session
Chair: Said Hanafi, ISTV2, LAMIH-SIADE, University of Valenciennes, Le Mont Houy, 59313, Valenciennes, said.hanafi@univ-valenciennes.fr

1 - Neighborhood exploration using mip solvers for a tank allocation problem

Lars Magnus Hvattum, Industrial Economics and Technology Management, Norwegian University of Science and Technology, Alfred Getz veg 3, Sentralbygg 1, N-7491 Trondheim, Norway, 7491, Trondheim, lars.m.hvattum@iot.ntnu.no, Kjetil Fagerholt, Vinícius Armentano

A subproblem in maritime bulk shipping is to allocate the cargos to the tanks of the ship. There are several constraints, such as the capacity of the tanks, hazmat regulations, and stability requirements. Using MIP solvers to find feasible solutions results in unpredictable running times. We examine the use of tabu search to create more robust solution methods. Neighborhoods are modeled as MIPs and explored using a commercial MIP solver. We discuss how various search components can be included in the neighborhood models, and evaluate the efficacy of this approach.

2 - A multi level branching strategy algorithm for the 01mdk

Michel Vasquez, LG12P, Ecole des Mines d’Alèes, Parc scientifique Georges Besse, 30035 cedex 1, Nîmes, France, Michel.Vasquez@ema.fr, Sylvain Boussier, Yannick Vimont, Said Hanafi, Philippe Michelon

We combine Resolution Search with 2 tree search algorithms to solve the 01MDK. RS enables to explore partially and iteratively hyperplanes with a fixed number of items while keeping completeness. It enhances the diversification of the search and improves the lower bound rapidly. This lb, associated with the ub, enforces the strength of the reduced costs constraint widely used in the second level variables enumeration. Finally, the item cardinality constraint is used to enumerate the lowest reduced cost variables. We prove optimality for all the 10 constraint 500 variable problems of OR-Library

3 - Inequalities and target objectives in metaheuristics for mixed binary program

Fred Glover, Leeds School of Business, University of Colorado, UCB 419, 80309-0419, Boulder, Colorado, United States, Fred.Glover@Colorado.edu, Saïd Hanafi

Recent metaheuristics for mixed binary program include inequalities and target objectives to guide the search. These guidance approaches are useful in intensification and diversification strategies and in strategies that use linear programming to generate trial solutions. We propose new inequalities and associated target objectives that create inequalities and trial solutions. We also propose supplementary linear programming models that exploit the new inequalities for intensification and diversification, and introduce inequalities from elite solutions that enlarge the scope of these models.
1 - The optimization of the fleet composition problem (tcp) in the distribution system

Piotr Sawicki, Faculty of Machines and Transportation, Poznan University of Technology, Institute of Machines and Motor Vehicles, 3 Piotrowo street, 60-965, Poznan, POLAND, Poland, piotr.sawicki@put.poznan.pl,
Marcin Kizinski, Jacek Zak, Adam Redner

The paper presents the bi-criterion optimization of the FCP in the fuel distribution system. The problem is formulated as an assignment of vehicles to incoming orders and expressed in terms of integer, non-linear programming. The solution procedure is composed of two phases. In the first one the Pareto-optimal solutions are generated by the Genetic Algorithms-based for MS Excel-Evolver solver. In the second phase the solutions are reviewed by the Light Beam Search method. The final solution results in the definition of the optimal fleet composition, including the number and type of vehicles.

3 - Mixed integer models for the inter-islands fuel oil distribution in cape verde

Alexandrino Delgado, DECM, Universidade de cabo Verde, 163, Mindelo, Cape Verde,
Alexandrino.Delgado@unicv.edu.cv, Agostinho Agra

We consider optimization problems arising in the inter-islands fuel oil distribution in Cape Verde, an archipelago with ten islands. Fuel oil products are imported and delivered into specific islands. From these islands (supply ports) fuel oil products are distributed among all the inhabited islands using a small heterogeneous fleet of ships. The optimization problems combine routing, inventory and scheduling. We discuss mixed integer linear formulations considering different issues such as time-windows, safety stocks, etc. Computational results based on real data are reported.

1 - Scheduling multiprocessor unit tasks of two sizes

Tamas Kis, Computer and Automation Research Institute, Kende utca 13-17, 1111, Budapest, Hungary, tamas.kis@sztaki.hu

We will study the following multiprocessor scheduling problems: There are m identical parallel processors, and n tasks. Each task j has unit execution time, a release date r(j), a due date d(j), and a requires either 1 or q out of the m processors concurrently. The processors are not dedicated. All the data is part of the input. Each processor can process at most one task at a time and preemption is not allowed. We describe a polynomial time algorithm for minimizing the number of late tasks under the assumption that the release dates and due dates of the q-processor tasks are agreeable.

3 - Scheduling on parallel processors subject to compatibility constraints

Mohamed Bendraouche, Faculty of Sciences, Saad Dahleb University, Route de Soumaa-Blida, Bp 270 Blida, 09000, Blida, Algeria, bendraouche_mohamed@yahoo.fr, Mourad Boudhar

We consider the problem in which jobs have to be scheduled non-preemptively on identical parallel processors. We assume that there exists a compatibility relation between the jobs such that two jobs are compatible if they can be scheduled simultaneously in any time interval. This relation is represented by a graph in which compatible jobs are represented by adjacent vertices. The aim is to minimise the makespan. We study the complexity of this problem for arbitrary graphs, bipartite graphs and the complement of bipartite graphs. We propose polynomial heuristics and test their performances.
1 - Structure similarity consensus as a measure of quality in protein structure prediction

Paweł Widera, School of Computer Science, University of Nottingham, Jubilee Campus, Wollaton Road, NG8 1BB, Nottingham, United Kingdom, pawel.widera@cs.nott.ac.uk, Daniel Barthel, Jonathan Garibaldi, Natalio Krasnogor

In protein structure prediction an evaluation of the quality of a predicted model is traditionally done by measuring the structural similarity of the model and the target structure. Several different measures have been in use for a last decade of CASP experiment (RMSD, GDT_TS, TM-Score, Max-CMO), each with its own individual strengths and drawbacks. In our ProCKSI structure comparison server we implemented a new consensus measure that combines the knowledge derived from the individual measures. Many interesting features emerged when the new measure was applied to the real world decoys.

2 - Cancer profiles by affinity propagation

Daniele Soria, IMA, School of Computer Science, University of Nottingham, Jubilee Campus, Wollaton Road, NG8 1BB, Nottingham, United Kingdom, dqis@cs.nott.ac.uk, Federico Ambrogi, Patrizia Boracchi, Jonathan Garibaldi, Elia Biganzoli

The Affinity Propagation (AP) algorithm is a novel clustering method proposed by Frey and Dueck in 2007, which combines advantages of both affinity-based and model-based clustering. In our work, the Affinity Propagation was applied to various problems of breast cancer and cutaneous melanoma. Results coming from AP were compared to the ones obtained with standard algorithms showing an overall agreement between different approaches. However, AP also provided novel insights with respect to the number of clusters to consider in a couple of data sets analysed, suggesting new possible cancer groups.

3 - A comparison of simulated annealing strategies for consensus clustering of microarray data

Enrico Glaab, School of Computer Science, University of Nottingham, Jubilee Campus, Wollaton Road, NG8 1BB, Nottingham, Nottinghamshire, United Kingdom, egg@cs.nott.ac.uk, Natalio Krasnogor, Jonathan Garibaldi

Consensus clustering is a valuable tool in data mining to aggregate multiple clusterings of the same data into a single representative clustering. Although the most common formulation of consensus clustering as an optimization problem, the median partition problem, is NP-complete, Simulated Annealing has been shown to provide good approximations to the solution. We compare the performance of different Simulated Annealing variants on simulated and real-world microarray data sets. The results provide guidance on the choice of the algorithm and the selection of the combined clustering methods.

4 - Case control analysis for snps data

Linda Fiaschi, University of Nottingham, Nottingham, NG8 1BB, NG8 1BB, Nottingham, United Kingdom, lxf@cs.nott.ac.uk

The study of the human genome has become one of the most challenging goals for scientists. Alteration of the DNA chain such as SNPs may affect a person’s response to drug therapy and confer a personal susceptibility or resistance to a certain disease. Pre-eclampsia (PE) is one of the disorder which is currently under genetic analysis for any heritable association. Within the different models that have been used by researchers for studying general genotype-phenotype associations, in this presentation I will show a new methodology based on case control analysis and applied to SNPs studies.
In this talk, we describe some efforts to implement scheduling algorithms in real-world wafer fabrication facilities. While scheduling is to a certain extent well understood in theory and efficient algorithms were suggested from academics, many efforts to implement scheduling systems fail in real-world plants. We identify and analyze some pitfalls that await the scheduling system developer and where possible, make tentative recommendations for how these pitfalls can be avoided or rectified.

4 - A column generation algorithm for the crew scheduling problem in waste management

Jens Baudach, Lehrstuhl für Verkehrssysteme und Logistik, Technische Universität Dortmund, Leonhard-Euler-Str. 2, 44227, Dortmund, NRW, Germany, baudach@vsl.mb.tu-dortmund.de, Annette Chmielewski

Planning waste management involves the two major resources: collection vehicles and corresponding crews. Our paper focuses on the optimization of individual crews for previously generated collection tours. First, we give a brief introduction in the process of waste disposal and discuss all aspects concerning the scheduling of crews. Second, we present a network-based column generation algorithm which uses a set partitioning approach with additional constraints and includes Lagrangean relaxation and subgradient optimization. Finally, computational results for real live data sets are shown.

MG-07

Monday 17:25-18:45

Optimizing transport and resources in traffic systems

Stream: Optimization in Public Transport

Invited session

Chair: Uwe T. Zimmermann, Institute of Mathematical Optimization, TU Braunschweig, Pockelsstrasse 14, 38106, Braunschweig, Germany, u.zimmermann@tu-bs.de

1 - Dynamic construction of time-discretized networks for very large scale operational railway planning

Frank Fischer, Mathematics, Chemnitz University of Technology, Reichenhainer Str. 39, 09107, Chemnitz, Germany, frank.fischer@mathematik.tu-chemnitz.de, Christoph Helmberg, Jürgen Jannen, Boris Krostitz

For the German railway network we search for a conflict free schedule for trains with given stopping intervals that observes sequence dependent headway times and station capacities. Our model uses time-discretized networks and configuration networks for the headway-constraints. The huge number of variables is handled by dynamic network generation within a combined Lagrangian relaxation and cutting plane approach. This is solved by a bundle method using primal aggregates for separation and rounding. Some promising results towards handling ten percent of the entire network are presented.

2 - Vehicle routing in waste management

Ronny Hansmann, Institut für Mathematische Optimierung, TU Braunschweig, Pockelstraße 14, 38106, Braunschweig, Germany, r.hansmann@tu-bs.de, Uwe T. Zimmermann

Planning waste management involves the two major resources: collection vehicles and crews. An ongoing project with two waste disposal companies aims at simultaneously planning the routes of the vehicles and the crews. In this talk we focus on the optimization of the routes. For our particular NP-hard Arc Routing Problem we present optimization approaches for determining efficient routes. Computational results for real-world data sets are shown. We finish the talk with some concluding remarks on future research towards the simultaneous approach for planning routes and crews.

3 - A new model for routing cars in rail freight service

Henning Homfeld, Mathematik, Technische Universität Darmstadt, Schlossgartenstr. 7, 64289, Darmstadt, Germany, homfeld@mathematik.tu-darmstadt.de, Armin Fügenschuh, Hanno Schülle

Cars in rail freight services at Deutsche Bahn follow prescribed routes from their origin via intermediate shunting yards to their destination. The goal in designing such routes is to reduce the number of trains and their travel distances. We present a new MIP model for this problem based on Steiner tree packings. Various real-world capacity constraints make the problem difficult to formulate and also to solve. We compare this model and its solutions using real-world data with our previous formulation based on multi-commodity min-cost flows.

MG-08

Monday 17:25-18:45

Case studies

Stream: Optimization in Public Transport

Invited session

Chair: Yuh-Jen Cho, Department of Transportation Technology and Logistics Management, Chung Hua University, No. 707, Sec. 2, Wufu Rd., 30012, HsinChu, Taiwan, Taiwan, yjcho@chu.edu.tw

1 - A study on the linehaul-feeder vehicle routing problem

Yuh-Jen Cho, Department of Transportation Technology and Logistics Management, Chung Hua University, No. 707, Sec. 2, Wufu Rd., 30012, HsinChu, Taiwan, Taiwan, yjcho@chu.edu.tw, Chih-Hsun Lin

Recently, some carriers used large trucks as the virtual depot to replenish small trucks. This study aims to propose a model, Linehaul-Feeder Vehicle Routing Problem (LFVRP) to deal with the mentioned case. Moreover, a metaheuristic method combining the Backtracking Adaptive Threshold Accepting (BATA) with neighborhood search heuristics is presented to solve the LFVRP. To identify the performance of BATA, a set of 58 LFVRP instances is generated to conduct computational experiments. Results indicated that the proposed BATA for solving the LFVRP is feasible and efficient.

2 - Tourism planning using public transport in Taiwan

Chih-Hung Chang, 707, Sec. 2, Wufu Rd., Hsinchu, Taiwan 300, R.O.C., 300, Hsinchu, Taiwan, d09403022@chu.edu.tw, Jau-Ming Su, Guei-Jhih Wang

The system for personal travel and demand conditions combined with public transport database and tourist attractions database for tourism planning and scheduling analysis. Traveler use web site to investigate tourist attractions. As a result, this study combined with tourism planning system technology and meeting the public transport trip planning methods to build a mass transit-based travel schedule planning system, to provide people traveling on board public transport to get the best travel itinerary planning.
3 - Real time scheduling optimization for airport man-
agement: a case study
Ludovica Adacher, DIA, Roma Tre University, VIA DELLA VASCA NAVALE 79, 00141, ROMA, ITALY.
Italy, adacher@dia.uniroma3.it, Marta Flamini
The growing gap between air traffic demand and limited airport capacity causes many congestion problems that can be limited by an optimal dynamic allocation of resources. We deal with a multi objective real time problem of scheduling aircrafts movements in Malpensa terminal.
We consider the minimization of the number of tardy flights and the minimization of the total time the aircrafts aeromotor is working, to improve airport performances and to limit air pollution, considering sophisticated safety constraints. We propose an alternative graph model and some heuristics procedures

4 - Optimal headway for feeder transit services: a case study in the texas border’s colonias
Luca Quadrifoglio, Civil Engineering, Texas A&M University, CE/TTI Bldg., 77843-3136, College Station, Texas, United States Minor Outlying Islands, lquadrifoglio@civil.tamu.edu
Colonias along the US-Mexico border are one of the most rapidly growing areas in Texas. Because of the relatively low income of the residents and an inadequate transportation services, the basic needs cannot be properly met. The objective of this paper is to determine the optimal headway of a potential feeder transit service operating in a representative Colonía (El Cenizo, TX) using real demand data collected through a travel survey. Results showed that the time interval between consecutive departures from the terminal should be around 11-13 minutes for best service quality.

■ MG-09
Monday 17:25-18:45
GSI - S 5
Human Resources Management I
Stream: Supply Chain Management
Invited session
Chair: Ming Liang, Mechanical Engineering, University of Ottawa, 770 King Edward Ave, K1N 6N5, Ottawa, Ontario, Canada, liang@eng.uottawa.ca

1 - The performance influence elements of dispatched worker at pharmaceutical industry of taiwan
Ying-Chyi Chou, Department of Business Administration, Thungai University, 181 Taichung-kang Rd., Sec. 3, Taichung, Taiwan, 407, Taichung, Taiwan, ycchou@mail.thu.edu.tw, Chien-Hua Hsiao, Pao-Long Chang
For rapid changing environment,enterprises struggle with unstable labor force and expensive human capital.To decrease the labor cost and enhance flexible human capital, enterprises start to hire temporary employees. Enterprises enjoy utilizing temporary employees, but falling into some managerial problems. The research objective is to explore the pros and cons of using temporary employees for the enterprises. From the “relationship marketing” perspective, we design and conduct a study to explore those important factors that may have strong influences on the performance.

2 - A heuristic procedure for recruiting and transition decisions in a hierarchical manpower system
Pao-Long Chang, Department of Business Administration, Fong Chia University, 100, Wenhsa Road, Seatwa,Taichung, Taiwan, R.O.C, 407, Taichung, Taiwan, paolong_chang@yahoo.com.tw
This model is frequently used as a forecasting model if P (t) is deterministic and independent of time. It also can be used as an optimization model with P (t) and Y (t) as variables to analyze the influence of recruitment and transition behavior on the size and the relative structure of organizations. Some commonly employed objective functions are, for example, to bring the relative personnel structure as near to a goal as possible, or to minimize a quadratic penalty function associated with labor, hiring, firing, etc. these criteria all fall into a quite general class of problems.

3 - Developing a temporary workforce transaction mechanism risk sharing perspectives
Ying-Chyi Chou, Department of Business Administration, Tunghai University, 181 Taichung-kang Rd., Sec. 3, 407, Taichung, Taiwan, ycchou@thu.edu.tw, Yen-Chen Lin
This paper assumes there are two opportunities for contract adjustment. The first adjustment is called “Period Quantity Adjustment”: During the time frame from the issuance of the order to right before the execution of the order, the user firm can use the most up-to-date labor force market information to adjust the original per period demand forecast of the various labor forces. Finally, this research will use sensitivity analysis and experimental design methodology to discuss the benefit of period quantity adjustment and total quantity adjustment.

4 - Job rotation methodology to cope with boredom at work
Ming Liang, Mechanical Engineering, University of Ottawa, 770 King Edward Ave, K1N 6N5, Ottawa, Ontario, Canada, liang@eng.uottawa.ca, Nader Azizi, Saeed Zolfaghari
Boredom is a common complaint in a repetitive working environment. It has serious consequences affecting both worker health and productivity. Job rotation has been recommended as a remedy for boredom at work. This paper presents a methodology to implement job rotation in manufacturing. For this purpose, several formulations are developed to measure and predict worker’s boredom and skill variations as they are transferred from one workstation to another. A mathematical model has been developed to optimize job rotation. The application of this model is illustrated using an example.

■ MG-10
Monday 17:25-18:45
GSI - S 6
Evolutionary Multiobjective Optimization
IV - Auctions
Stream: Evolutionary Multi Objective Optimization
Invited session
Chair: Gülşah Karakaya, Industrial Engineering, Middle East Technical University, Endustri Muhendisligi Bolumu, Orta Dogu Teknik Universitesi, 06531, Ankara, Turkey, gulsah@ie.metu.edu.tr

1 - Collaborative planning in detailed scheduling
Benedikt Scheckenbach, Kolbenzeil 15, 69126, Heidelberg, benedikt.scheckenbach@gmail.com
In SCM, the problems of suppliers and manufacturers are typically interdependent - however, the prevailing practice is to solve them independently. That is, the manufacturer optimizes his production first, generating a supply plan for his suppliers who calculate their optimal production plans subsequently. This prioritization of the manufacturer’s objectives leads to suboptimal results. To reach a better alignment of objectives we propose a decentral evolutionary algorithm. We explain the main ideas and present several results for real planning scenarios based on the SAP APO PP/DS optimizer.

2 - Bi-objective winner determination in truck contract procurement auctions

Tobias Buer, Dept. of Information Systems, FernUniversität - University of Hagen, Profistr. 8, 58084, Hagen, Germany, tobias.buer@fernuni-hagen.de, Giselher Pankratz

This contribution examines the determination of winning bids in the tendering of trucking contracts. The underlying optimization problem is modeled as a bi-objective extension to the set covering problem. It is solved by two Pareto-optimization heuristics, the first of which is based on GRASP, whereas the second is based on an evolutionary algorithm. The heuristics are tested with the aid of a new set of problem instances. These instances comply with the free disposal property, which is an important assumption specific to trucking contract procurement. Results of this comparison are presented.

MG-11
Monday 17:25-18:45
GSI - S 17

Theoretical advances in MCDA

Stream: Multiple Criteria Decision Analysis

Invited session

Chair: Michel Grabisch, CES, Université Paris I - Panthéon-Sorbonne, 106-112 Bd de l’Hôpital, 75013, Paris, France, michel.grabisch@univ-paris1.fr

1 - A characterization of the 2-additive Choquet integral by using a cardinal information

Brice Mayag, Thales Research & Technology, Campus Ecole Polytechnique, 1 Av. Augustin Fresnel, 91767, Palaiseau cedex, bmayag@yahoo.fr, Michel Grabisch, Christophe Labreuche

In the context of MCDA, we present necessary and sufficient conditions to obtain a representation of a cardinal information by a Choquet integral w.r.t. a 2-additive capacity. These conditions are based on some complex cycles called balanced cycles. The cardinal information is the type MACBETH.

2 - Processing additional information in a multiple criteria context with information imperfections: an aggregation procedure including the weak preference relation

Sarah Ben Amor, Telfer School of Management, University of Ottawa, 55 Laurier E (7123), K1N6N5, Ottawa, Ontario, Canada, benamor@telfer.uottawa.ca, Jean Marc Martel

Any decision situation, particularly any multiple criteria decision aid process, is inevitably confronted with different kinds of information imperfections (uncertainty, imprecision . . . ) It is then natural to seek additional information to reduce these imperfections. A unified procedure is proposed to allow for processing additional information in such a context. It is based on the Bayesian decision model. It leads to prior and posterior global preference relational systems containing the strict preference, the weak preference, the indifference and the incomparability relations.

3 - Analysing the correspondence between strict and non-strict outranking relations

Marc Pirlot, Mathematics and Operational Research, Faculté Polytechnique de Mons, Rue de Houdain 9, B-7000, Mons, Belgium, marc.pirlot@fpms.ac.be, Denis Bouyssou

Some outranking methods like ELECTRE yield preference relations that can be described as ‘at least as good as relations’ while others, like TACTIC, yield ‘better than’ relations. We analyse outranking relations of both types in a conjoint measurement framework and we study the correspondence between them. We stress in particular that a strict outranking relation (with vetoes) cannot be described as the asymmetric part of some non-strict outranking relation and we elaborate on this.

MG-12
Monday 17:25-18:45
GSI - S 18

Emerging Applications of Simulation

Stream: Stochastic Programming

Invited session

Chair: David Munoz, Industrial & Operations Engineering, Instituto Tecnológico Autónomo de México, Rio Hondo # 1, Colonia Tizapan San Angel, 01000, Mexico City, Mexico, davidm@itam.mx

1 - Modeling, simulation and analysis of a securities settlement system

Miguel De Lascurain, Instituto Tecnológico Autónomo de México, 01000, Mexico City, Mexico, mdelasc@itam.mx, Arturo Palacios, David Munoz, Omar Romero

We report the modeling, simulation and analysis of a new Securities Settlement System (SSS) implemented by INDEVAL, the Central Securities Depository of Mexico. The main objective of this research was to use reduced amounts of cash within reasonable periods of time for the settlement of securities using a linear programming model for the clearing of operations. The performance of the new SSS was evaluated by performing experiments using a deterministic simulation model under different operation parameters.

2 - Bayesian forecasting of spare parts using simulation

David Munoz, Industrial & Operations Engineering, Instituto Tecnológico Autónomo de México, Rio Hondo # 1, Colonia Tizapan San Angel, 01000, Mexico City, Mexico, davidm@itam.mx, Omar Romero

This article illustrates the development and application of a model that was used to forecast the demand for spare parts based on data from a car dealer in Mexico as well as a novel simulation application. The potential of simulation as a powerful tool to represent and solve a complex forecasting model is illustrated in this work.

3 - Algorithms for the generalized weighted frequency assignment problem

Diego Munoz, Instituto Tecnológico Autónomo de México, 01000, Mexico City, Mexico, dkedmun@gmail.com, David Munoz
We report the performance of 15 construction heuristics to find initial solutions, and 7 search algorithms to solve a frequency assignment problem where the value of an assigned frequency is determined by the site where it is assigned. Our experimental results show that the construction heuristics that consider the weights of the sites perform better. On the other hand, among the 7 search algorithms tested, an algorithm based on stochastic search that uses the concept of cross entropy performed significantly better than the others.

MG-13
Monday 17:25-18:45
GSI - S 31
Stochastic programming III.
Stream: Stochastic Programming
Invited session
Chair: Alexei Gaivoronski, Industrial Economics and Technology Management, Norwegian University of Science and Technology, Alfred Getz vei 1, 7491, Trondheim, Norway, alexei.gaivoronski@iot.ntnu.no

1 - Goodness-of-fit tests for uniformity and internal and external sorting
Thomas Morgenstern, IWI Informatik und Wirtschaftsinformatik, Hochschule Karlsruhe — Technik und Wirtschaft, Moltkestrasse 30, 76133, Karlsruhe, Baden-Württemberg, Germany, thomas.morgenstern@hs-karlsruhe.de
Goodness-of-fit tests like the Kolmogorov-Smirnov and the Chi-Square test involve sorting and classification of random numbers. The application of Bucket Sort and Merge Sort reduces significantly the computation time of tests with many numbers, e.g. empirical tests of random number generators. Controlling the process with a priority queue allows further improvements, like partial sorting only.
Keywords: goodness-of-fit tests, floating point number sorting, MSD radix sort, merge sort, random number generation, stochastic programming (MSC 2000: 68P10, 65C60, 65C10).

2 - A MIP approach to dynamic graph reliability with dependences
Nicole Nowak, TU Darmstadt, 64289, Darmstadt, Germany, nowak@mathematik.tu-darmstadt.de
Dynamic graph reliability problems occur in many real world applications. Production planning in mechanical engineering is one of these. For non-dynamic graph reliability problems dynamic programming approaches are known. However, the dynamic problem is PSPACE-hard. Hence, any approach leading to tractable models is of interest. Dependencies between probabilities of edges cause difficulties in finding a suitable model. We approach the problem from a mixed integer programming point of view and will present models and first solution approaches to problem variants and sub-problems.

3 - Stochastic programming models for distribution of scarce resources under uncertainty
Alexei Gaivoronski, Industrial Economics and Technology Management, Norwegian University of Science and Technology, Alfred Getz vei 1, 7491, Trondheim, Norway, alexei.gaivoronski@iot.ntnu.no

We present stochastic programming models for distribution of scarce resources under stochastic demand. Often it is not enough to maximize profit/minimize cost. We aim at striking balance between risk of not meeting demand satisfaction targets and performance in terms of cost and profit, borrowing ideas from financial theory. Two application examples are presented: one from maintenance of service contracts in high tech industry and another from water resource management. Architecture of decision support system is discussed and results of numerical experiments are provided.

MG-14
Monday 17:25-18:45
GSI - S 32
Experimental OR
Stream: Experimental Economics and Game Theory
Invited session
Chair: Andreas Novak, Business Administration, Brunnererstrasse 72, A-1210, Vienna, andreas.novak@univie.ac.at
1 - A differential game related to terrorism: stationary Nash and Stackelberg strategies
Andreas Novak, Business Administration, Brunnererstrasse 72, A-1210, Vienna, andreas.novak@univie.ac.at, Gustav Feichtinger, George Leitmann
The question of how best to prosecute the ‘war on terror’ leads to strategic interaction in an intertemporal setting. We consider a non-zero sum differential game between a government and a terrorist organization. Due to the state separability of the game we are able to determine stationary Nash and Stackelberg solutions in analytic form. Their comparison as well as the sensitivity analysis deliver interesting insight into the design of efficient measures to combat terror.

2 - Defining Stackelberg equilibria on discrete multilayered networks
Dmitrii Lozovanu, Institute of Mathematics and Computer Science, Academy of Sciences of Moldova, Academiei 5, IML, MD-2020, Chisinau, Moldova, Moldova, Republic Of, lozovanu@math.md, Stefan Pickl
The author introduces specific control problems on so-called multilayered networks. These extend classical deterministic control problems. Stackelberg equilibria are defined. Suitable algorithms are derived exploiting the underlying multilayered structure.

3 - Cooperation within a pdg with unknown length
Ulrike Leopold-Wildburger, Statistics and Operations Research, Karl-Franzens-University, Universitätsstraße 15/E3, 8010, Graz, Austria, ulrike.leopold@uni-graz.at
The study examines the influence of pre-existing individual differences in social value orientations measured by the outcomes to oneself and others according to the ring measure by McClintock 1978. We run a simulation in the lab to be able to figure out the high percentage of cooperation in a PDG in which the length of the game is unknown to the players and the fact that cooperation is significantly dependent on the type of the subjects. The experiment study found out that prosocial people demonstrated significantly more cooperation than proselsh within a PDG.

4 - System dynamics and experimental design supporting the simulation and the analysis of a complex lotka-volterra system
Stefan Pickl, Department for Computer Science, Universität der Bundeswehr München, heisenbergstr.
In this work we tackle a modification of the well-known extended algorithm is able to find the new best known solution. For several instances, the proposed algorithm follows a destruct-and-repair paradigm, where the depot after completing their service. Given an initial feasible solution, the method attempts to minimize the global size of the used bins. We study the behaviour of the heuristic Next Fit Using Largest bins only. We propose a new polynomial heuristic named Improved Best Fit which has an upper bound of two for solving two cases: increasing order and decreasing one.

General Lotka Volterra Systems can be used to simulate and analyze cooperative and non-cooperative behaviour within n-players conflict situations. The authors present an approach which applies techniques from System Dynamics to identify certain equilibria solutions. Experimental settings are used to characterize these solutions in such a way that the impact of parameter changings and human behaviour is analyzed for distinguished examples.

### MG-15

**Monday 17:25-18:45**

**Einstein**

**Optimizing routes**

Stream: Vehicle Routing

**Invited session**

Chair: Juan José Salazar González, Estadística e Investigación Operativa, Universidad de La Laguna (Tenerife), Av. Astrofísico Francisco Sánchez, s/n, 38271, La Laguna, Tenerife, Spain, jjsalaza@ull.es

1 - Valid inequalities for the cvrp obtained by projecting a capacitated multicommodity flow formulation

**Maria João Lopes**, Departamento de Métodos Quantitativos, ISCTE - IUL, Centro de IO da FCUL, Av. das Forças Armadas, 1649-026, Lisboa, Portugal, mj@iscte.pt, Luis Gouveia

We present valid inequalities for the Capacitated Vehicle Routing Problem that are obtained by projecting the set of feasible solutions of the Linear Programming relaxation of a Capacitated Multi-commodity Flow formulation into the space of variables involved in a Capacitated Single-Commodity Flow formulation. Other inequalities are obtained by strengthening some of these valid inequalities.

2 - An ilp improvement procedure for the open vehicle routing problem

**Paolo Toth**, DEIS, University of Bologna, Viale Risorgimento 2, 40136, Bologna, Italy, paolo.toth@unibo.it, **Majid Safari, Andrea Tramontani**

We present a heuristic improvement procedure for the Open Vehicle Routing Problem (OVRP), a variant of the Capacitated and Distance Constrained VRP in which the vehicles are not required to return to the depot after completing their service. Given an initial feasible solution, the method follows a destruct-and-repair paradigm, where the given solution is randomly destroyed and repaired by solving an ILP model. We report computational results on benchmark instances from the literature. For several instances, the proposed algorithm is able to find the new best known solution.

3 - A randomised method for solving the line design problem for connected rapid transit networks

**Laureano Fernando Escudero**, Dept. de Estadística e Investigación Operativa, Universidad Rey Juan Carlos, c/Tulipán, S/n, 28933, Mostoles (Madrid, Spain), laureano.escudero@urjc.es, **Susana Muñoz**

In this work we tackle a well-known extension of the Circular Transit Network design problem to allow the definition of circular lines and to obtain a connected network. It is assumed that whichever two stations are linked by one line at most. Given the stations and the links between them to be constructed, we propose a randomised greedy heuristic procedure that attempts to minimise the number of transfers that should be done by the users to arrive at their destinations, in such a way that the number of lines that pass through each station is as small as possible.

### MG-16

**Monday 17:25-18:45**

**Koenig**

**Cutting and Packing 3**

Stream: Cutting and Packing

**Invited session**

Chair: J. M. Valério de Carvalho, Departamento de Produção e Sistemas, Universidade do Minho, 4710 053, Braga, Portugal, ve@dps.uminho.pt

1 - A constructive bin-oriented algorithm for the two-dimensional bin packing problem with guillotine cuts

**Christoforos Charalambous**, Frederick University, 1036, Nicosia, Cyprus, c.charalambous@frederick.ac.cy, **Khalil Hindi, Krzysztof Fleszar**

A constructive, bin-oriented algorithm addressing the 2DBP∗G problem is presented. The algorithm propagates by deciding a set of items to occupy the bin base and subsequently addressing the remaining free subspaces by applying the same algorithm in a recursive fashion. The items that occupy the base are decided by using a first-fit approach on various sorting sequences and adaptively employing a combination of space-utilisation and average-item-area for determining which to apply. Results on benchmark problems show improved performance on all classes in moderate execution times.

2 - A branch-and-cut-and-price approach for a bus school problem

**Juan José Salazar González**, Estadística e Investigación Operativa, Universidad de La Laguna (Tenerife), Av. Astrofísico Francisco Sánchez, s/n, 38271, La Laguna, Tenerife, Spain, jjsalaza@ull.es, **Jorge Riera-Ledesma**

The problem is designing a set of optimal school bus routes with the purpose of carrying students to their schools. We are given with schools and bus stops. Each bus stop is reachable by some students, possibly going to different schools. The aims are assigning students to stops and finding least-cost trips and choosing a vehicle to serve each trip. We propose an integer linear formulation, and several families of valid inequalities are derived to strengthen the linear relaxation. A branch-and-cut-and-price procedure has been developed, and an extensive computational experience is presented.
in this paper we deal with a dynamic online stochastic multimode resource constrained project scheduling problem. Due dates for the starting and finishing times of the tasks and temporal constraints are considered. We develop several surrogate measures of robustness on the idea of emptying those types of workers which would be required for future ‘expected’ tasks. Those surrogate measures are used in a proactive-reactive method and the sensibility of the method is tested against (a) “decrease in the workforce’ and (b) “increase in the expected duration”.

4 - 2d parameterized models for project management test generation
Constanta-Nicoleta Bodea, Economic Informatics, The Academy of Economic Studies, 15-17, Calea Dorobanti Street, Sect 1, Bucharest, 010552, Bucharest, Romania, bodea@ase.ro, Maria Dascaliu

The paper proposes two models for project management test generation, using assessed knowledge difficulty and diversity as parameters. One model is a test generator producing tests with L, level of difficulty. It selects a minimum number of questions, having the required difficulty level and covering all the concepts related to the assessed competences. The second model chooses k questions covering most of the concepts needed by assessed competence. Both models consider the test generation as a constrained optimization problem and use a knowledge representation based on concept space graphs.

3 - Sensibility and robustness in a dynamic and online rcpsp/max problem.
David Gómez-Cabrero, Clinical Gene Networks AB, Clinical Gene Networks AB, Karolinska Sience Park,
The Multi-commodity Capacitated Multi-facility Weber Problem (MCMWP) is concerned with locating I capacitated facilities in the plane to satisfy the demand of J customers to K distinct commodities with the minimum total transportation cost. Given fixed customer locations, demands and capacities, the commodity flow between each pair of facility and customer is subject to road capacity constraints. The MCMWP is a non-convex optimization problem and difficult to solve. We propose several efficient heuristics for MCMWP and report computational experiments on randomly generated test instances.

3 - A feasible direction method for nonsmooth nonconvex optimization

Mario Tanaka Filho, Mechanical Engineering, Federal University of Rio de Janeiro, CAIXA POSTAL 68503 CIDADE UNIVERSITARIA 21945-970 - Rio de Janeiro, RJ - Brazil - Caixa-Postal: 68503, 21945-970, Rio de Janeiro, Rio de Janeiro, tanaka@ufpa.br.

A technique for locally Lipschitz continuous functions is proposed. We define an equivalent constrained nonlinear program EP. A sequence of auxiliary linear programs AP is constructed by substitution of the constraints of EP by cutting-planes. A Feasible Descent Direction for AP is obtained, based on the Feasible Directions Interior Point Algorithm, FDIPA, and a step-length is computed. The step length is considered serious if an appropriate rule is satisfied. If the step is not serious, AP is updated and a new search direction is computed. This is repeated until a serious step is obtained.

4 - Simplex based solution of convex quadratic programming problems

Zsolt Csizmadia, Fair Isaac, Trinity 64, CV32 5YN, Leamington Spa, United Kingdom, zsoltcsizmadia@fairisac.com

The talk presents the numerical behavior of four different simplex based approaches to convex quadratic programming problems: a cut generation and a column generation approach inspired by methods from nonlinear programming, a generalized direct primal simplex method, and the simplex based solution of the Karush-Kuhn-Tucker system. We identify problem classes that are the most suitable to each approach, as well as presenting worst case scenarios. The presented results are based on recent research related to the enhancement of the simplex based quadratic solver in the FICO Xpress-MP suite.

MG-19

Monday 17:25-18:45
Haber

Genetic Algorithms

Stream: Metaheuristics

Invited session

Chair: André Rossi, Lab-STICC - UBS, Université Européenne de Bretagne, 56100, Lorient, France, andre.rossi@univ-ubs.fr

1 - Tuning genetic algorithms by using simulation optimization techniques

Helcio Vieira Junior, Divisão de Engenharia Mecânica, Instituto Tecnológico de Aeronáutica, Praça Marechal Eduardo Gomes, 50 - Vila das Acácias, 12.228-900, São José dos Campos, SP, Brazil, helcio@ita.br, Karl Heinz Kienitz, Mischel Carmen N. Belderrain

Adequate tuning of Genetic Algorithm (GA) parameters is very important to achieve good performance but trial and error procedures can be very time-consuming. To solve this problem, we propose the use of the Simultaneous Perturbation Stochastic Algorithm to perform the tuning of GA parameters. We implemented the Simple Genetic Algorithm (SGA) to optimize two difficult test-functions. The SGA with optimally tuned parameters achieved an average improvement of 64.2% and 40.7% in, respectively, 100 independent replicas of the Griewank and Pincher test-functions in relation to the non-optimized SGA.
Some specific geometric DEA models are well known to the researchers in DEA through so-called multiplicative or log-linear efficiency models. Valuable properties of these models were noted by several authors but the models still remain somewhat obscure and rarely used in practice. The purpose of this paper is twofold: to show from a mathematical perspective where the geometric DEA fits in relation to the classical DEA, and through some example geometric DEA models to demonstrate their further beneficial properties in practice of decision making and/or efficiency measurement.
Optimization in Sustainable Energy

Invited session
Chair: Steffen Rehbnack, Industrial and Systems Engineering, University of Florida, 303 Weil Hall, P.O. Box 116595, 32611, Gainesville, Florida, United States, steffen@ufl.edu
Chair: Niko Iliadis, PSR / EnerCoRD, Plastira street 4, Nea Smyrni, 171 21, Athens, Greece, nikolaos.iliadis@a3.epfl.ch
Chair: Panos Pardalos, ISE Department, University of Florida, 303 Weil Hall, FL 32611, Gainesville, Florida, United States, pardalos@ufl.edu

1 - Electricity and CO2 emissions system prices modeling and optimization
Niko Iliadis, PSR / EnerCoRD, Plastira street 4, Nea Smyrni, 171 21, Athens, Greece, nikolaos.iliadis@a3.epfl.ch, Steffen Rehbnack, Mario Veiga Pereira, Panos Pardalos

We present two stochastic models optimizing a power system; from the perspective of a global system and from a sub-system’s perspective within a liberalized market. CO2 emission quotas and certificate prices are considered. The first model seeks to compute the electricity system marginal price and the CO2 emissions marginal price by minimizing the system’s operation cost. In the second model, the revenues of the sub-system are maximized while considering stochastic inflows, electricity, fuel and CO2 prices. The resulting stochastic linear program will be solved via hybrid SDP/SDDP.

2 - Wind farm layout optimization
Michele Samorani, Leeds School of Business, University of Colorado at Boulder, UCB 419, 80309-0419, Boulder, CO, United States, michael.samorani@colorado.edu, Harald Reinertsen, Manuel Laguna

Wind is the fastest growing source of renewable energy. Wind turbines are grouped in wind farms in order to keep the construction and maintenance costs low. Finding the optimal positions of wind turbines in the farm is a challenging problem: the wake effect reduces the wind speed behind a turbine and therefore also the energy production of the turbines downwind. We propose a stochastic mixed 0-1 linear formulation, where we consider all wind directions. This leads to a better layout and higher revenue for the wind farm operator than previously proposed methods.

3 - Managerial biases and energy savings: an empirical analysis of the adoption of process improvement recommendations
Charles Corbett, UCLA Anderson School of Management, 110 westwood plaza, box 951481, 90095-1481, Los Angeles, CA, United States, charles.corbett@anderson.ucla.edu, Suresh Muthulingam, Shlomo Benartzi, Bohdan Oppenheim

We investigate adoption of energy efficiency initiatives using a database of over 100,000 recommendations provided to more than 13,000 small and medium sized manufacturing firms in the U.S. We identify four managerial biases. Managers are myopic; they are more influenced by upfront costs than by net benefits; adoption of a recommendation depends on the sequence in which the recommendations are presented; adoption is not influenced by the number of options provided to decision makers.

2 - Wind farm layout optimization
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Theory of Semi-infinite Programming

Stream: Semi-Infinite Optimization

Invited session
Chair: Francisco Guerra-Vázquez, Actuaría y Matemáticas, Universidad de las Americas, Ex Hacienda Sta Catarina Martir S/N, 72820, Cholula, Puebla, Mexico, francisco.guerra@udlap.mx

1 - A local duality theorem for nonconvex semi-infinite programming problems

Francisco Guerra-Vázquez, Actuaría y Matemáticas, Universidad de las Americas, Ex Hacienda Sta Catarina Martir S/N, 72820, Cholula, Puebla, Mexico, francisco.guerra@udlap.mx, Jan-J Ruckmann

A local convexification result of the Lagrangian function for finite nonconvex optimization problems with inequality constraints was obtained by D. Li and X. L. Sun (J. Optim. Theor. Appl. 104, No. 1, 2000, 109-120), under the linear independence constraint qualification and the second-order sufficiency condition. We show that, a similar result can be obtained for semi-infinite optimization problems under a weaker condition, namely, at the local minimizer the Extended Mangasarian-Fromovitz constraint qualification holds.

2 - Explicit exchange method for convex semi-infinite programming problems with second-order cones

Shunsuke Hayashi, Graduate School of Informatics, Kyoto University, Yoshida-Honmachi, Sakyo-Ku, 606-8501, Kyoto, Japan, shunhaya@amp.i.kyoto-u.ac.jp, Soon-Yi Wu

We consider the convex semi-infinite programming problem with second-order cone constraints (for short, SOCCSIP). The purpose of this study is to propose an explicit exchange method for solving SOCCSIP. Under some mild conditions, we prove that the algorithm terminates in a finite number of iterations and the output is an approximate solution of SOCCSIP by using the so-called complementarity slackness condition with second-order cone and the spectral factorization in Euclidean Jordan algebra. Preliminary numerical results are reported to illustrate the effectiveness of the algorithm.

3 - The exact feasibility of randomized solutions of semi-infinite convex programs

Marco Campi, University of Brescia, Brescia, Italy, marco.campi@ing.unibs.it, Simone Garatti

In previous contributions, it has been shown that solutions to convex semi-infinite programs that bear a high probability to satisfy the constraints can be obtained at low computational cost through constraints randomization. Here, we present a new fundamental result on the exact feasibility of the randomized solution: the portion of unsatisfied constraints has a Beta distribution for all fully-supported programs. Moreover, the feasibility of the randomized solutions for all other programs can be bounded based on the feasibility result for the prototype class of fully-supported programs.
Transportation Planning

Stream: Discrete Optimization

Contributed session

Chair: Damien Prot, LICIT, INRETS, 25, avenue François Mitterrand, 69675, Bron Cedex, France, damien.prot@inrets.fr

1 - Application of transportation model to the fleet operations problem of flour mills of nigeria plc.

Joshua Magbagbeola, BUSINESS ADMINISTRATION (OPERATIONS RESEARCH), UNIVERSITY OF LAGOS, UNIVERSITY OF LAGOS, AKOKA, LAGOS STATE, NIGERIA, 234, AKOKA, LAGOS, kunle_magbagbeola@yahoo.com

This paper presents the problem of determining the number of vehicles needed to provide a demand representative transit (DRT) service with a predetermined quality for the user in terms of waiting time at the stops and maximum allowed detour. This methodology can be much more effective and straightforward compared to a simulation approach whenever detailed data on demand patterns are not available. Computational results under a fairly broad range of test problems show that the model can provide an estimation of the required size of the fleet in different scenarios.

2 - Optimizing reserve capacity of urban road networks, by the concurrent design of one-way and two-way links and lane additions

Elnaz Miandoabchi, Faculty of Industrial Engineering, Amir Kabir University of Technology, 424, Hafez Ave, 15875, Tehran, Tehran, Iran, Islamic Republic Of, el.miandoabchi@aut.ac.ir, Reza Zanjirani Farahani

This paper addresses the problem of designing street directions and lane additions in urban road networks, based on the concept of reserve capacity. The problem is to find the optimum configuration of one-way and two-way streets and the optimum selection of street lane addition projects, considering the maximization of reserve capacity, in two problem variations. The proposed problems are modeled as mixed-integer bi-level mathematical models. A genetic algorithm and an evolutionary simulated annealing algorithm are proposed to solve the models. Computational results are presented.

3 - Capacity analysis of railway lines from the perspective of new transport service providers.

David Canca, School of Engineers, University of Seville., Av. de los Descubrimientos s/n, Isla de la Cartuja, 41092, Seville, Spain, dco@us.es, Alejandro Zarzo, Enelis Palma

The EU policy on transport shows a strong commitment to use of rail transport. This paper, from a mixed model of scheduling and re-scheduling, analyzes the actual capacity of railway tracks shared by different service providers. The initial interest lies in knowing the potential number of trains that can be scheduled in the existing free intervals. We discuss the desirability of modifying the infrastructure in order to allow train overlapping and overtaking. This work was developed with the support of projects CEDEX, PT-2007-003-08CCPP and Andalusian Government. Ref P06-TEP-02219.

4 - Connecting maximum air traffic density and colouration problems

Damien Prot, LICIT, INRETS, 25, avenue François Mitterrand, 69675, Bron Cedex, France, damien.prot@inrets.fr, Sophie Constua, Rémy Fondacci, Christophe Rapine

We define and study the maximum density problem linked to the design of a new European air traffic system. Our aim is to minimize the number of conflicts between aircraft flying on orthodromic routes. We model this problem as the search for a special independent set on the conflicts graph: this set has to be dense on each route. An additional difficulty arises because the conflicts graph is infinite; however the problem can be represented in a compact way with another graph modeling. We show a link between our problem and coloration. We give upper and lower bounds on the density of a solution.

Auctions

Stream: Auctions

Contributed session

Chair: Georg Ziegler, Boltzmannstr. 3, 85748, Garching, Germany, georg.ziegler@mytum.de

1 - Optimal procurement auctions design with endogenous quantity

Junyi Pu, Industrial & Manufacturing System Engineering, The University of Hong Kong, Room 824, Haking Wong Industrial, The University of Hong Kong, 100027, Hong Kong, joseph.jypy@gmail.com, Lingyau Chan

This paper studies the optimal auction design for a buyer faced with multiple competing suppliers. It is known that the buyer can maximize its profits by using a payment-quantity schedule in an auction. This paper shows that a well-designed demand schedule which specifies the quantity as a function of price can also be optimal. The new approach equals the former one under certain settings, which helps to explain the reasons why the former approach is sensitive to different auction formats.

2 - Xml-based data standard for market clearing mechanisms

Eugeniusz Toczyłowski, Institute of Control & Computation Engineering, Warsaw University of Technology, Nowowiejska 15/19, 00-665, Warsaw, mkaleta@elka.pw.edu.pl, Mariusz Kaleta, Kamil Smolira, Piotr Palka, Przemyslaw Kacprzak, Izabela Zoltowska, Tomasz Traczyk

A great number of different attempts to the market clearing mechanisms can be observed. These attempts are hard to compare on the common test cases due to huge effort needed for data adaptation. M3 is a XML-based data model, which describes the input and output data of a market clearing process, which usually takes a form of optimization task. Its main advantage is high expressiveness. M3 covers most of the known trade mechanisms, including different auction types, multi-commodity mechanisms, bilateral contracts. An on-line repository of the tools and reference data cases is established.

3 - Combinatorial versus multi-commodity auction for indivisible network resources allocation

Kamil Koltyś, Institute of Control and Computation Engineering, Warsaw University of Technology, ul. Nowowiejska 15/19, 00-665, Warsaw, Poland, K.J.Koltyś@elka.pw.edu.pl, Izabela Zoltowska, Eugeniusz Toczyłowski, Piotr Palka
Efficient bandwidth trade requires development of advanced business tools. Auctions seem to be the best forms of optimized trading mechanisms, facilitating end-to-end network paths trading. We analyse two important types of mechanisms auctioning indivisible amounts of bandwidth: combinatorial and multicommodity auctions. The comparison of both approaches is based on a large set of test data generated from the SNDlib library. It is performed in terms of allocation, revenue and computational efficiency.

4 - On the worst-case efficiency of the combinatorial clock auction

Georg Ziegler, Boltzmannstr. 3, 85748, Garching, Germany, georg.ziegler@mytum.de, Martin Bichler, Pasha Shahalin

For many combinatorial auctions (CAs) no formal solution concept is available. However, CAs are promising to increase economic utility. The US Federal Communication Commission (FCC) has discussed several CA formats and used one in an auction of frequency licenses last year. Worst case efficiency analysis of CAs has not been discussed in the literature so far although it helps to understand what can go wrong and provides a benchmark of certain CA designs. We show the worst case efficiency of the Combinatorial Clock auction under different assumptions on bidding behavior and auction size.

MG-28
Monday 17:25-18:45
GSI - S 1
Financial Optimization 4
Stream: Financial Optimization
Invited session
Chair: Giacomo Patrizi, Statistica, Probabilita’ e Statistiche, Applicate, La Sapienza, University of Rome, Piazza Aldo Moro 5, 00185, Rome, g.patrizi@caspur.it
1 - Own-company stockholding and work effort preferences of an unconstrained executive
Sascha Desmettre, Department of Financial Mathematics, Fraunhofer ITWM, Fraunhofer Platz 1, 67663, Kaiserslautern, Germany, sascha.desmettre@itwm.fraunhofer.de, John Gould, Alexander Szimayer

We develop a framework for analyzing an executive’s own-company shareholding and work effort preferences. The executive invests his personal wealth without constraint in the financial market, including the shares of his own company whose value he can influence by work effort. The executive’s investment and work effort strategy is derived in closed-form, and an indifference utility rationale is used to determine his compensation. Our results have implications for the assessment of executive quality, e.g. our executive’s investment in his own company’s shares identifies his work effectiveness.

2 - Dynamic analysis of empirical stochastic financial processes
Laura Di Giacomo, Statistica, Probabilita’ e Statistiche, Applicate, La Sapienza Universita’ di Roma, Piazza Aldo Moro 5, 00185, Rome, Italy, lauradg@caspur.it, Giacomo Patrizi

Models to determine optimal control policies of empirical financial processes require simultaneous estimation and optimization techniques, through a dynamic constrained system specification. The dynamic processes must be considered non stationary and exhibit uncertainty effects, often modelled as additive components but should not be excluded from the model. The algorithm is described and certainty equivalent solutions are derived. This dominates other approaches which are limited by the assumptions of efficient markets, linear disturbances and stationary series.

MG-29
Monday 17:25-18:45
GSI - S 2
Financial Aspects of Energy Topics
Stream: Energy and Emission Markets
Invited session
Chair: Steffen Rebennack, Industrial and Systems Engineering, University of Florida, 303 Weil Hall, P.O. Box 116595, 32611, Gainesville, Florida, United States, steffen@ufl.edu
Chair: Nikos Iliadis, PSR / EnerCoRD, Plastira street 4, Nea Smyrni, 171 21, Athens, Greece, nikolaos.iliadis@a3.ep.ch
Chair: Panos Pardalos, ISE Department, University of Florida, 303 Weil Hall, FL 32611, Gainesville, Florida, United States, pardalos@ufl.edu
1 - Managing risk through option contracts on the strategic petroleum reserve

Fernando Oliveira, Operations Management, Essec Business School, Avenue Bernard Hirsch – BP 50105, 95021, Cergy-Pontoise, oliveira@essec.fr, Frederic Murphy

We design and evaluate financial options for market-based management of the U.S. government’s Strategic Petroleum Reserve (SPR). We use a Markov Game to model the interactions between a public player that maximizes social welfare and a representative private player that can be a pure speculator or a refiner. We value the options required to manage the SPR. We show how the options trading model can be used to partially finance the SPR and that a market-based management of the SPR can be used to manage private risks.
2 - Centralized and decentralized compressed air storage for enhanced grid integration of wind power

Reinhard Madlener, RWTH Aachen University, 52056, Aachen, Germany, rmadlener@eonerc.rwth-aachen.de, Jochen Latz

We model the economic feasibility of compressed air storage (CAS) to improve wind power integration. The base case is a wind park with 100 MW installed capacity and no storage facility. In Variant 1 we add a central CAS system with 90 MW compressor and 180 MW generation capacity. The CAS system is operated independently of the wind park so profits at the spot market and reserve power market are maximized. Variant 2 is an integrated, decentralized CAS system, where each wind turbine is equipped with a compressor and no generator.

3 - Power plant investments under uncertainty

Ralf Schemm, BET Aachen, 52070, Aachen, Germany, Ralf.Schemm@bet.aachen.de

The approach examines investment decisions in power generation technologies and the resulting power price in the year 2040 with the help of a stochastic bid-based spot model. The decision process is based on modern portfolio theory, whereby decisions under uncertainty are made by considering the trade-off between the mean and risk parameters of the portfolio return in an utility function. The focus of this analysis is on the parameters and the degree of technological diversification of the optimal portfolio decision and their dependence on the risk aversion of the investors.

2 - Separable relaxation for nonconvex quadratic integer programming: an integer diagonalization approach

Xiaoling Sun, School of Management, Fudan University, 670 Guoshun Road, Shanghai 200433, P. R. China, 200433, Shanghai, China, xls@fudan.edu.cn

1 - Separable relaxation for nonconvex quadratic integer programming: an integer diagonalization approach

Xiaoling Sun, School of Management, Fudan University, 670 Guoshun Road, Shanghai 200433, P. R. China, 200433, Shanghai, China, xls@fudan.edu.cn, Xiaojin Zheng, Duan Li

We present an integer diagonalization approach for deriving new lower bounds for general quadratic integer programming problems. Semi-unimodular transformations are introduced to diagonalize a symmetric matrix and meanwhile preserve integral property of the feasible set. Separable quadratic integer program can then be obtained as a relaxation of the nonseparable quadratic integer program via semi-unimodular transformation. Lagrangian decomposition and convex relaxation schemes for the relaxed separable quadratic integer programming problem are analyzed and their tightness are compared.

2 - Cardinality constrained quadratic optimization

Jianjun Gao, System engineering and Engineering management, The Chinese University of Hong Kong, Room 910a, MMW Engineering Building, The Chinese University of Hong Kong, Shatin, N.T, Hong Kong, NA, Hong Kong, Hong Kong, jjgao@se.cuhk.edu.hk, Duan Li

We consider in this paper the problem of minimizing a strictly convex quadratic function subject to a cardinality constraint. Such a problem formulation naturally arises in portfolio selection and statistical analysis. Motivated by a geometric point of view that solving such a problem is equivalent to finding the minimum-volume ellipsoid that touches an s-subspace, where s is the given cardinality number, we propose in this research some efficient bounds. By integrating such bounds into a branch and bound algorithm, CCQO problems with a relatively large size can be solved efficiently.

3 - Convex relaxation for nonconvex quadratic programming problems: best d.c. decomposition and sdp formulation

Duan Li, Systems Engineering & Engineering Management, Chinese University of Hong Kong, Shatin, NT, Hong Kong, 00000, Shatin, NT, dli@se.cuhk.edu.hk, Xiaojin Zheng, Xiaoling Sun

We investigate a general convex relaxation scheme via D.C. decompositions for linearly constrained nonconvex quadratic programming and reveal an equivalence between the “best” parametric D.C. decomposition and its corresponding semidefinite relaxation formulation. We gain dual benefits from this interesting equivalence: (i) Reduction of the iterative dual search process in finding the best D.C. decomposition to a single SDP formulation, and (ii) Identification of a feasible solution of the primal problem by solving the convex relaxation corresponding to the SDP solution.

1 - Data mining for mutual funds' success drivers and future performance

Steve Frensch, Chemical Engineering, University of Toronto, Department of Chemical Engineering & Applied Chemistry University of Toronto, 200 College Street, M5S 3E5, Toronto, Ontario, Canada, s.frensch@utoronto.ca

With data from the Canadian Mutual Fund industry this paper looks at applications of machine learning to better understand fund level asset flows. Existing work in this field has traditionally used linear regression forecasting models, yet has also uncovered nonlinear relationships between past performance and asset flows. This paper investigates methods of incorporating nonlinearities into existing empirical models as well as looking at the forecasting performance gains from using machine learning algorithms to select attributes and construct nonlinear asset flow forecasting models.

2 - Probabilistic delay-accuracy trade-off in trend turning detection of noisy stock time series

Hang Yu, 605 W Madison St Apt #1613, 60661, Chicago, IL, United States, garyyh@yahoo.com
In this paper, we establish a statistical model to quantify the link between delay and accuracy in turning point detection for stock time series. We model stock prices as an aggregation of a trend and a noise. The trend is modeled as a Poisson process after empirical analysis and the noise is modeled as an ARCH process. We perform a closed form analysis and obtain a theoretical relationship between the accuracy-delay trade-off for the linear filtering de-noising technique. We verify the solution by our experiment on real stock time series.

3 - Analyzing financial resource structuring patterns using data mining: evidence from Istanbul stock exchange

Banu Esra Aslaner, Business Administration, Dokuz Eylul University Faculty of Business, Kaynaklar Campus Tyınaztepe, Buca, 35160, Izmir, esra.aslaner@deu.edu.tr, Sabri Erdem

The two basic types of creating financial resources are to make debt and/or equity financing. The balance between these two mainly determines the resource portfolio of the companies. This study examines the financial resource types in a portfolio using data mining techniques like association rules, cluster analysis. The aim is to find the relations between the portfolio structures and company characteristics. The data is derived from the companies’ financial statements and their disclosures that were registered in ISE. The results will provide great benefits to financial decision makers.

4 - Evaluating the impact of adding a new retail to an existing loyalty club

Maximo Bosch, Industrial Engineering, University of Chile, Republica 701, Santiago, Chile, mbosch@di.uchile.cl, Jose Godoy

We present the case of a Loyalty Club with a large number of associate retailers that needs to estimate the impact of introducing a new member to the alliance. A new retailer is expected to increment to the existing club sales. We model sales on different groups of customers. Groups were formed according their card use behavior. Bellalah (1999) firstly incorporated the information cost into an real option model (ROM) for R&D valuation. However, the Bellalah’s model though exhibited the R&D’s market value based upon information cost; it failed to depict the change of R&D’s payoff within project’s lifetime. More than this, it is plausible of that the R&D may depreciate while time elapses; its value could also vanish over night because of some exceptions for example the ‘protocol’ change. The aforesaid issues were not addressed by Bellalah therefore we are trying to propose a modified model for supplementation.

2 - Black investment holes in ID2S

John-Christ Panayiotopoulos, Informatics, University of Piraeus, Karoni 80, 18534, Piraeus, Greece, jcp@unipi.gr, Pavlos Petrantanakis

Investing in new products with no history is a dangerous task. The investment is even more risky in the case of Irregular Dynamic Data Space (ID2S), where the data changes within a given planning horizon in an unknown way. Consequently, an optimal solution based on the data of present, it is possible to become a complete disaster within our planning horizon. Not only we will not get a maximum profit, but we will lose and our initial budget too. The present work proposes some new considerations on Investment theory in order to avoid such black investment holes.

3 - Design of experiments on ANN’s training data for predicting Turkish IPOs

Sabri Erdem, Business Administration, Dokuz Eylul University Faculty of Business, Tinaztepe Kampusu, BUCA, 35160, IZMIR, Turkey, sabri.erdem@deu.edu.tr, Ayşun Kapucugil-ikiz, Yılmaz Goksen

This study employs Design of Experiments methodology to achieve lower training error and better performance of an Artificial Neural Network (ANN) model for prediction. The main motivation is to predict returns of Turkish Initial Public Offerings (IPOs) affected by often noisy/incomplete data. To price IPOs, an ANN model using publicly available financial data as inputs and output is developed. The dataset is completely transformed into categorical variables to enclose most common situations. Feeding these categorical variables to our ANN model reduced the error compared to the traditional one.

4 - Value versus growth: a rational expectations exposition

M E Shah, Nottingham University Business School, University of Nottingham, Jubilee Campus, NG8 1BB, Nottingham, lixmesm@nottingham.ac.uk

This paper investigates the value growth puzzle in the context of conflict of interest between taxable and institutional investors. We model this conflict in a rational expectations framework and demonstrate how the differences in firm’s characteristics and the risk profile of the investors can explain the shape of CAPM’s frontier in the overall economy without involving the beta parameter. We also explicate that the changes in taxable and non-taxable investors profile in a dynamic environment rationalize the value growth premium as illustrated by Malkiel (2003).
In this paper, we consider a multiobjective programming problem
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1 - Global optimization with a set of lipschitz constants
for the first derivative

Dmitri Kvasov, Department of Electronics, Computer
Science and Systems, University of Calabria, DEIS,
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A global optimization problem is considered where the objective
function is univariate, black-box, and its first derivative satisfies
the Lipschitz condition with an unknown Lipschitz constant. Methods
working with a set of Lipschitz constants for the objective function
are known (e.g., DIRECT method), whereas algorithms working in
this way with the objective function having a Lipschitz derivative
have not been proposed until now (see: Optimization Letters, 3(2),
2009, pp. 303-318). In this talk, such an algorithm is presented and
discussed together with results of numerical experiments.

2 - A lexicographic approach on unconstrained opti-
mization

Christina D. Nikolakakou, Department of
Mathematics, University of Patras, Patras University
Campus, 26504, Rio, Greece, c_nikol@yahoo.gr,
Theodoula N. Grapsa, Ioannis A. Nikas, George S. Androulakis

In this paper a lexicographic approach is applied to solving un-
constrained optimization problems. The original problem is trans-
formed to an equivalent multiobjective optimization one. Moreover,
prioritizing the objective functions contributes on alleviating the
problem of convergence to the same local minima. Thus, the us-
age of our lexicographic technique may converge to global optima.

3 - Some optimality and duality results for multiobjec-
tive measurable subset selection problems under
weaker assumptions of convexity

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Statistics and Applied Mathematics, The Romanian
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Stancu-Minasian

In this paper, we consider a multiobjective programming problem
involving n-set functions. We shall present some sufficient effi-
ciency optimality conditions and duality results under various gen-
eralized (F, b, ρ, ho, heta)-univexity hypotheses, where F is convex,
not as usually, a sublinear application. Moreover, an application to
the fractional case is indicated.
Multimethodology, the practice of combining together different OR methodologies, is becoming increasingly popular. This study will report on the results of a survey of OR practitioners that is currently being carried out, and on a review of multimethodology case studies that have been published in the literature. The results will throw light on the extent of successful use of multimethodology; combinations of methods that are particular popular or successful; and areas for future theoretical or methodological developments.

2 - Developing visually-enhanced problem structuring methods for wicked problems
Steven Barr, 17 Onslow Road, KT3 4AR, London, steven.barr@paconsulting.com
Rosenhead and Mingers have classified Problem Structuring Methods (PSMs) for making progress with ill-defined, ‘wicked’ problems. Simple visualisation is commonly used in support of PSMs (eg rich pictures and strategy maps). Enhanced visualisation for example in ‘info-murals’ can enhance public policy decision making. A new generation of PSMs integrated with effective visual tools could help stakeholders to make better progress with wicked problems, by: Improving access to the debate; Communicating uncertainty more clearly; and Supporting collaboration on sustainable solutions.

3 - Value priorities in organizations through problem structuring methods
Leroy White, University of Bristol, BS8 1TN, Bristol, United Kingdom, leroy.white@bristol.ac.uk
It is now widely accepted that policy and strategy development requires both an appreciation of values and an ability to involve insights from stakeholders. This paper presents research about values, policy making and problem structuring (PSM). Developments in identifying more clearly value priorities of stakeholders will be presented, and alongside PSMs they provide the potential for new avenues for PSM research and practice.

4 - Understanding problem structuring interventions in multi-organizational settings: a frame analytical perspective.
L. Alberto Franco, Warwick Business School, University of Warwick, ORIS Group, Gibbet Hill Road, CV4 7AL, Coventry, United Kingdom, alberto.franco@warwick.ac.uk, Ashley Carreras
This presentation proposes frame analysis as a potential means to better understand problem structuring interventions in multi-organisational settings. Frame analysis enables the clarification of the potential role and impact of PSMs within the dynamic processes of framing that take place within problem structuring interventions. We illustrate its use by drawing on data gathered from an intervention conducted for a collaboration between a global organisation and its joint venture partners. Implications for the understanding and evaluation of PSM interventions are also offered.
4 - Optimal storing strategy

Nils Unger, University of Karlsruhe (TH), Kaiserstr.20, 76351, Linkenheim, Germany, nils.unger@fb.uni-karlsruhe.de, Marliese Uhrig-Hoernburg

In this paper, we investigate the valuation of storage contracts. We present novel properties of the underlying stochastic control problem. These results can be used to reduce execution time and to improve stability of the numerical solution. Our analysis establishes the relevant set of delivery contracts and shows how trading policy depends on these. We show how admissible strategies can be restricted to a subset without affecting the solution of the optimization problem. Finally, we provide conditions that are sufficient in order to characterize the optimal control by exercise boundaries.

MG-37
Monday 17:25-18:45
GS1 - S 12
Applications in Revenue Management
Stream: Revenue Management
Invited session
Chair: Ayse Kocabiyikoglu, Department of Business Administration, Bilkent University, Bilkent, 06800, Ankara, Turkey, aysekoca@bilkent.edu.tr

1 - Salesforce incentives in revenue management
Ayse Kocabiyikoglu, Department of Business Administration, Bilkent University, Bilkent, 06800, Ankara, Turkey, aysekoca@bilkent.edu.tr, Ioana Popescu

In numerous revenue management settings, capacity management decisions are delegated to the salesforce, whose objectives are often not aligned with those of the firm’s, hence leading to allocation policies that are suboptimal from the firm’s point of view. In this paper, we study the optimal allocation decision of a sales agent under a number of incentive schemes and provide comparisons. We also investigate the impact of various problem parameters on the agent’s decision.

2 - Estimation of cross-price elasticities and markdown optimization in an apparel retailer
Ufuk Kula, Industrial Engineering, Sakarya University, Esentepe Kampüsü, 54187, Sakarya, Turkey, ukula@sakarya.edu.tr, Ayhan Demiriz

An important problem that retailers face is markdown optimization. Single product stochastic demand markdown optimization problem may be solved by using dynamic programming. However, when substitution between a group of products exists, as the number of products in the group increase, it becomes very difficult to find the optimal markdowns for products. We use an apparel retailer’s sales data first to estimate substitution effects between products by using multinomial logit model (MNL). Then, we use approximate dynamic programming to find the optimal markdown policy for the retailer.

3 - Revenue management and rail freight transportation
Luce Brotcorne, LAMMI-SIADE, Universite de Valenciennes, Le Mont Houy, 59313, Valenciennes cedex 9, France, luce.brotcorne@univ-valenciennes.fr, Ioana Bilegan, Dominique Feillet, Yezekael Hayel

We consider a freight rail transportation problem where a carrier strives to maximize revenue by efficiently allocating capacities taking into account punctual demands as well as estimations of future demands for container transportation. We propose a revenue management approach based on solving a mathematical program with respect to a space-time modelling of the transportation network. Numerical results are given.

MG-38
Monday 17:25-18:45
GS1 - S 13
Accounting for Lean Operations
Stream: Lean Accounting
Invited session
Chair: DeWayne Searcy, School of Accountancy, Auburn University, 301 Lowder Business Building, 36849, Auburn, AL, searcydl@auburn.edu

1 - Evaluating the benefits of volume flexibility instruments using design-of-experiments methods
Matthias Walter, Institut für Wirtschaftswissenschaft, Technische Universität Clausthal, Julius-Albert-Str. 2, 38678, Clausthal-Zellerfeld, Germany, matthias.walter@tu-clausthal.de, Thomas Sommer-Ditrich, Jürgen Zimmermann

Volume flexibility enables firms to cope with demand variability but flexibility is not a free good. Hence, firms are challenged to choose adequate volume flexibility instruments. To tackle this challenge we present a framework based on a model that minimizes production costs taking into account volume flexibility instruments. We use design-of-experiments methods to assess the impact of each instrument and their interactions. In a case study we apply our framework to a real life production system to gain managerial insights into the value of different combinations of flexibility instruments.

2 - Providing relevant information in a lean environment: an empirical model of lean accounting
Rosemary Fullerton, School of Accountancy, Utah State University, 3540 Old Main Hill, 84322-3540, Logan, Utah, United States, rosemary.fullerton@usu.edu, Frances Kennedy

Traditional accounting fails to provide relevant information to Lean organizations. An emerging accounting approach, coined Lean accounting (LA), is better suited to lean firms, with information simpler to prepare, easier to understand, and more useful for decision making. The exploratory survey study examines issues related to accounting practices and Lean environments. The SEM results suggest that LA firms demonstrate the following: top management support; empowered workers; lean manufacturing tools; visual, strategic information; reduced inventory tracking; and simplified accounting systems.

3 - Performance benefits of the lean strategy
Frances Kennedy, Accountancy and Legal Studies, Clemson University, 301 Senn Halls, Clemson, SC, fkenned@clemson.edu, Lisa Jackson

Lean can be a costly business strategy that affects all the people in an organization. Accountants and business leaders are looking for justification for the investment in lean and breakthroughs in understanding the effects of lean on the financial results and activities of the business. The purpose of this research is to provide empirical support for the performance benefits of lean manufacturing by comparing a sample of Lean companies to competitors of similar size.
4 - Gaining back-office control using lean principles: action research at amg, inc.

DeWayne Searcy, School of Accountancy, Auburn University, 301 Lowder Business Building, 36849, Auburn, AL, searcydl@auburn.edu

In February 2008, AMG’s management embarked on a lean journey hoping to gain control over their rental operations. The lean transformation was a success. Decision-making improved, transactions were eliminating, efficiencies were gained, and profits increased. The lean implementation affected the rental operations, the accounting system, and the control environment. This study describes AMG’s the lean transformation. The author used action research by assuming the role of a facilitator and guided the organization through its lean-office implementation.

MG-39
Monday 17:25-18:45
GSI - S 14
Coalitions
Stream: Game Theory
Contributed session
Chair: Kirill Pogorelskiy, State University "Higher School of Economics", Myasnitskaya str., 20, 101000, Moscow, Russian Federation, kirill.pogorelskiy@gmail.com

1 - Bargaining schemes in games with fuzzy coalitions
Tomas Kroupa, Institute of Information Theory and Automation of the ASCR, Pod Vodarenkou vzei 4, 182 08, Praha 8, kroupa@utia.cas.cz, Jiri Vomlel

Bargaining scheme in a game with fuzzy coalitions is an iterative procedure for generating a sequence of payoffs that eventually converges to a payoff from the Aubin’s core of the game. We study two kinds of bargaining schemes. First, the Cimmino type bargaining scheme introduced by Butnariu and Kroupa, which is useful for finding a common point from an intersection of infinitely many compact convex sets. Second, the Dykstra algorithm originating in probability theory, which enables to speed up the convergence whenever the game with fuzzy coalitions is convex.

2 - Power and preferences: an experimental approach
Kirill Pogorelskiy, State University "Higher School of Economics", Myasnitskaya str., 20, 101000, Moscow, Russian Federation, kirill.pogorelskiy@gmail.com, Fuad Aleskerov, Alexis Belianin

This paper uses experiments to study the voting power distribution. Taking the work by Montero.Selfonk&Zhang/Soc Choice Welf.2008,30:69—87 as starting point, we confirm their basic findings and explain some of their empirical paradoxes. Our main contribution deals with the question of how voters’ preferences to coalitions influence their behavior and payoffs. We extend the basic design to allow for asymmetric voters’ preferences depending on the coalitions they take part in. The results show that even small modifications of preferences lead to statistically significant differences in players’ shares.

3 - Core membership testing for additive hedonic coalition formation games
Kouji Suzuki, Department of Industrial and Systems Engineering, Aoyama Gakuin University, Room 415, Building O, 5-10-1 Fuchinobe, 2298558, Sagamihara, Kanagawa, Japan, koujjs0830@gmail.com, Shao-Chin Sung

We are concerned with the problem of core membership testing in additive hedonic coalition formation games. The problem is to test whether a given coalition structure is stable or not in a certain sense. We first provide a short proof of Co-NP completeness of the problem when core stability is under consideration. Then, we show that the problem remains Co-NP complete when either strict core stability or strong core stability is under consideration. Moreover, we show that the existence problem of strong core stable coalition structure is NP hard.

MG-40
Monday 17:25-18:45
GSI - S 27
Development in Asian Countries
Stream: OR for Development and Developing Countries
Invited session
Chair: Graham Rand, The Management School, Lancaster University, Dept. Of Management Science, LA1 4YX, Lancaster, Lancashire, United Kingdom, g.rand@lancaster.ac.uk
Chair: Gerhard-Wilhelm Weber, Institute of Applied Mathematics, Middle East Technical University, ODÜ, 06531, Ankara, Turkey, gweber@metu.edu.tr

1 - Managerial accounting: cost systems in thai organizations
Thanatas Tupmongkol, School of Accounting, Sripatum University, 61 Phaholyothin Road, 10900, Bangkok, tupmongkol@hotmail.com

The purpose of this study is to investigate the cost systems in the Thai organizations. The survey consists of 385 mailed questionnaire responses, and giving the response rate of 19%. The results show that 80% are still using the traditional accounting system, the standard costing and absorption costing are the most popular to use as a cost technique. The majority of respondents indicate that the current cost systems provides good and adequate cost information. They have not considered an activity-based costing (ABC) system because too costly, and due to a lack of knowledge of ABC.

2 - An exploratory study of supply chain management in China
Lawrence Fredendall, Department of Management, Clemson University, 101 Sirrine, 29634-1305, Clemson, SC, United States, lfreden@clemson.edu, Peter Letmathe, Nadine Uebe-emden
Overall trade volume between China and Germany in 2006 exceeded 76 billion Euro and many German companies continued to invest in production sites throughout China. There is limited understanding of the problems that face these investors and how they manage these problems within their existing supply chains. This is an empirical study conducted through telephone interviews with managers responsible for Chinese production sites. This study examined management differences between companies involved in joint ventures and companies which operated their Chinese facilities independently.

3 - "altruism under pressure: experimental evidence from Indonesia"

Laura Marie Schons, Marketing, Ruhr University Bochum, Universitatsstrasse 150, 44780 Bochum, 44780, Bochum, NRW, Laura.Schons@rub.de

Ultimatum Game experiments have been played numerous times and the bottom line is clear: the results robustly contradict the economic model of human behavior. However in the existing literature, the role of the respondent’s income has been largely ignored. Where the respondent’s income has played a role, the lack of variance in income restricts the interpretability of the results. We use a sample of 75 respondents from Indonesia. Compared to previous studies, we find a significantly lower degree of reciprocal punishment for those respondents who are subject to severe economic pressure.

3 - A total allowable catch quota in the common sardine (strangomera bentincki) and anchovy (engraulis ringens): a multispecies Chilean fishery

Víctor Albornoz, Departamento de Industrias, Universidad Tecnica Federico Santa Maria, Av. Santa Maria 6400, 6671219, Santiago, Chile, victor.albornoz@usm.cl, Cristian Canales

In this paper the authors present an optimization model as a planning tool in the simultaneous exploitation of common sardine and anchovy. In Chile, the most important fishing regulation instrument is the establishment of global and individual capture quotas for each regulated resource, whose values are based on a total allowable capture quota, incorporated as a decision variable in such model. The proposed decisions must take into account the species mixture in their catches and must be based on the knowledge of the population dynamic behavior through aging and spatial mathematical relations.
3 - Using simulation to assess a novel public health scheme with spatial complexities

Karen J Cairns, Centre for Statistical Science and Operational Research (CenSSOR), Queen’s University Belfast, University Road, BT7 1NN, Belfast, United Kingdom, k.cairns@qub.ac.uk, Adele Marshall

Assessing the benefits of a novel public health scheme with mobile cardiac First-Responders (FRs) is not straightforward given its stochastic and spatial nature e.g. cardiac arrest occurrences across timespace; response times of ambulances/FRs; long-term survival. A Monte-Carlo simulation-based model has been constructed. Validation was via comparison with observed in a sub-region of the UK. The benefits in a different rural region, under various FR configurations, have been evaluated. These conclude that the scheme would not be the most efficient use of National Health Service resources.

4 - Categorizing diseases based on digital protocols

John-Christ Panayiotopoulos, Informatics, University of Piraeus, Karaoli & Dimitriou 80, 18534, Piraeus, Greece, jcp@unipi.gr, Pavlos Petrantoniakis

So far there has not been some digital standardization of diseases. In this paper, it is proposed a new approach based on digital protocols. For each disease category a matrix of symptoms is introduced which offers the capability of automated diagnosis. Furthermore, an expert diagnosis support system is presented which also may be used as a Tutor to new practitioners.

3 - Risk-based assessment and management of total petroleum hydrocarbon contamination

Aisha Bello-Dambatta, School of Engineering, Computing and Mathematics, Harrison Building, New Park Road, University of Exeter, EX4 4QF, Exeter, United Kingdom, ab353@exeter.ac.uk, Akbar Javadi

Petroleum hydrocarbon contamination is the most common form of soil and groundwater contamination in the urban environment. This contamination pose risks to human health via various exposure pathways. We present a Web-based knowledge-based management system for sustainable management which works by carrying out a site specific risk assessment and evaluation to identify exposure pathways by comparisons and rule-based inferences from the knowledge-base. If remedial action is needed, the system finds the most sustainable remedial alternatives and rank them in order of the most sustainable.

4 - Dynamic simulation of trb1 region : projections and scenarios

Hasan Soylu, Econometrics, Inonu University, Inonu University Business Administration Faculty, Econometrics Department, 44280, Malatya, Turkey, hsoyler@inonu.edu.tr

Regional development models have many feedback loops, will change over time and have nonlinear structure. System dynamics is effective way for modelling of socio-economic system, making predictions in future, providing improvement in the system of policies. This study is about to analyze socio-economic development model of TRB1 Region (Malatya-Elazig-Bingol-Tunceli) using system dynamics approach. To ensure socio-economic development in the region to the country level, model will run according different scenarios through 2009-2030. This study is supported by TUBITAK.

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1 - A decomposition approach for stochastic dynamic programming models of reservoir networks

Thomas Archibald, School of Management, University of Edinburgh, 50 George Square, EH8 9JY, Edinburgh, United Kingdom, T.Archibald@ed.ac.uk

Stochastic dynamic programming is often used to model reservoir control problems. However, in most practical cases, these models are computationally intractable due to the high dimension of the state and action spaces. This paper presents an approach which decomposes the problem into low-dimensional subproblems, each concentrating on one reservoir in the network. The approach works well for certain types of reservoir network under the objective of maximizing expected value. The paper examines how the approach can be adapted for different networks and objectives which take more account of risk.

2 - The value of a domestic photovoltaic power station

John Boland, School of Mathematics and Statistics, University of South Australia, Masons Lakes Blvd., 5095, Masons Lakes, South Australia, Australia, john.boland@unisa.edu.au

An innovative method is proposed for determining the economic worth of the use of PV cells for electricity production in the urban environment. Instead of estimating the payback period, the system is regarded simply as the investment of capital in an additional feature added to the domestic dwelling. The analysis is performed using stochastic programming techniques. The objective is to minimise the capital value that has to be added to the house with solar radiation and ambient temperature being stochastic inputs to give a payback period of a predetermined time.

3 - Stochastic control of river systems

Julia Piantadosi, School of Mathematics and Statistics, University of South Australia, Masons Lakes Campus, Masons Lakes Boulevard, Masons Lakes, 5095, Adelaide, South Australia, julia.piantadosi@unisa.edu.au

Almost every major water supply system in Australia is under stress. This is true of metropolitan systems in all mainland capital cities and many of the important river systems especially the Murray-Darling. We wish to determine new management policies that satisfy environmental constraints and user demands subject to appropriate regard for the future health of the river. A crucial issue is managing the various risks involved, which will be formulated via Conditional Value-at-Risk (CVaR). It is well known that CVaR is a robust measure that can be used in stochastic optimization procedures.

4 - Addressing variability in renewable and decentralised energy systems

Simon Dunstall, Mathematical and Information Sciences, CSIRO, Australia, Simon.Dunstall@csiro.au, Andreas Ernst, Rodolfo Garcia-Flores, Gaurav Singh, Rene Weiskircher

The management of renewable and/or decentralized energy generators within an energy market is complicated by short and long-term variability in energy sources, prices and demand for electrical and heat outputs. For residential combined-heat-and-power systems, for example, we must predict and react to changes in heat energy demand while optimizing for emissions, economics or both. We present methods for addressing this variability and uncertainty that we have used for research into large-scale decentralized energy deployments and the use of batteries to smooth wind farm power output.
Tuesday 08:00-09:20

■ TA-01
Tuesday 08:00-09:20
Beethoven
Recent advances in combinatorial optimization I
Stream: Combinatorial Optimization
Invited session
Chair: Andrea Lodi, D.E.I.S., University of Bologna, Viale Risorgimento 2, 40136, Bologna, Italy, andrea.lodi@unibo.it
Chair: Michele Monaci, D.E.I., University of Padova, Via Gradenigo 6/A, 35131, Padova, Italy, monaci@dei.unipd.it
1 - Optimal patchings for consecutive ones matrices
Marc Pfetsch, Institute for Mathematical Optimization, Technische Universität Braunschweig, Pockelsstr. 14, 38106, Braunschweig, Germany, m.pfetsch@tu-bs.de, Giovanni Rinaldi, Paolo Ventura
We deal with the problem to find the minimal number of 0s of a 0/1-matrix that have to be changed to yield a matrix that has the consecutive ones property. We discuss an application in production planning, the corresponding polytopes, and a branch-and-cut approach that builds on old and new cutting planes. Furthermore, the algorithm features inequalities that are obtained via the equivalence of separation and optimization - the corresponding optimization problems are solved by a dynamic programming algorithm on submatrices. At the end, we present computational results.

2 - Integer knapsacks: average behavior of the Frobenius numbers
Iskander Aliev, School of Mathematics, Cardiff University, Senghennydd Road, CF24 4AG, Cardiff, aliev@cf.ac.uk
Feasibility of integer knapsacks is known to be closely related to the behavior of associated Frobenius numbers. In the present talk we show that the asymptotic growth of the Frobenius number in average is significantly slower than the growth of the maximum Frobenius number. The obtained results also imply a new upper estimate for Frobenius numbers. The talk is based on a joint work with Martin Henk (Magdeburg).

3 - Computer aided discovery of families of valid inequalities
Stefan Ropke, Department of Transport, Technical University of Denmark, Bygningsstvet 115, 2800, Kgs. Lyngby, Denmark, sr@transport.dtu.dk, Jean-Francois Cordeau, Gilbert Laporte
When designing a branch-and-cut method for a specific problem class it is important to know classes of valid inequalities for the problem. We present a computer program that helps the user discovering new families of valid inequalities. It does so by finding simple valid inequalities that are violated by a fractional solution supplied by the user. It is up to the user to generalize these examples further. We will present examples of new families of inequalities for the capacitated vehicle routing problem and the traveling salesman problem with pickup and deliveries found using the program.

4 - A framework for solving sub- and supermodular problems
Gerald Lach, Institut für Mathematik, TU Berlin, Straße des 17. Juni 136, 10623, Berlin, Berlin, Germany, lach@math.tu-berlin.de, Marco Lübbecke
Several combinatorial problems can be described using normalized monotone increasing, sub and supermodular functions. Many of these functions, which describe real world problems, include a more restrictive characteristic, which we call antichainwidth-boundedness. An example of such a function is the supermodular functions describing the single machine scheduling polytope. The facets of these polymatroids possess an unexplored combinatorial structure. Based on this structure we introduce a mathematical framework, which provides an oracle free separation algorithm for this kind of problems.

■ TA-02
Tuesday 08:00-09:20
Schumann
Online Planning in Vehicle Routing and Scheduling
Stream: Transportation Planning
Invited session
Chair: Joern Schoenberger, Chair of Logistics, University of Bremen, Wilhelm-Herbst-Strasse 5, 28359, Bremen, Germany, jsb@uni-bremen.de
1 - Online planning: challenges and lessons learned
René Schumann, Computer Science, Information Systems and Simulation, Goethe Universität Frankfurt, Robert-Mayer-Str. 10, 60325, Frankfurt, Germany, reschu@informatik.uni-frankfurt.de, Juergen Sauer
Shifting the focus from offline to online planning implies changes that increase complexity tremendously. Optimality can only be proven ex-post. Events triggering planning actions must be abstracted from primitive data. Effects where no stable plan exists must be avoided. A key challenge is the notion of robustness. Robustness reduces the number of needed repair steps but is in conflict with classical objective functions. In the article we point out the aspects mentioned and survey how these issues have been tackled in Artificial Intelligence planning and scheduling.

2 - Data provision for time-dependent vehicle routing in city logistics
Jan Fabian Ehmk, Decision Support Group, Business Information Systems, Mühlenforstdstraße 23, 38106, Braunschweig, Germany, j.f.ehmke@tu-bs.de, Dirk Christian Mattfeld
Customer-oriented vehicle routing in city logistics demands for the consideration of congestion in urban infrastructure. Therefore, telematics based data collection technology provides traffic data in a large extent. This data is analyzed by Data Mining methods and described by an information model, which is used in time-dependent vehicle routing algorithms. In this context, customer time windows are considered.

3 - Methods for the real-time distribution of perishable goods using past request information to forecast future demand
Francesco Ferrucci, WINFOR (Business Computing and Operations Research), University of Wuppertal, Gaußstraße 20, 42119, Wuppertal, NRW, Germany, fferrucci@winfor.de, Stefan Bock, Michel Gentreau
This talk introduces a real-world variant of the well-known Dynamic Vehicle Routing Problem (DVRP). In this DVRP, goods have to be delivered under extreme time pressure because of their high perishability. In order to increase quality of service, future demands are anticipated by applying sophisticated methods for analyzing historical data and request forecasting. The efficiency of the applied instruments is analyzed using computational experiments. Besides designed test scenarios, results obtained for a real-world case of subsequent deliveries of a German newspaper vendor are presented.
4 - Approximate dynamic programming for routing a service vehicle with stochastic customer requests

Stephan Meisel, Information Systems, Technical University Braunschweig, Abt-Jerusalem-Str. 4, 38106, Braunschweig, stephan.meisel@tu-bs.de, Dirk Christian Mattfeld

We present an Approximate Dynamic Programming approach to a dynamic vehicle routing problem with one vehicle and stochastic requests. Two groups of customers are considered. Early customers definitely request for service, whereas late request customers appear randomly over time according to individual request probabilities. Late requests must be either confirmed or rejected after becoming known. The goal is serving the maximum number of customers within a fixed period. The performance of our approach is compared to the performance of state-of-the-art waiting strategies and a greedy heuristic.

TA-03
Tuesday 08:00-09:20
Reger
Container Terminal Planning
Stream: Transportation Planning
Invited session
Chair: Jörg Wiese, DS&OR Lab, University of Paderborn, Warburgerstr. 100, 33098, Paderborn, Germany, wiese@upb.de

1 - Integer programs for designing optimal container yards

Jörg Wiese, DS&OR Lab, University of Paderborn, Warburgerstr. 100, 33098, Paderborn, Germany, wiese@upb.de, Leena Suhl, Natalia Kliewer

The container yard is the main part of a container terminal layout. We define different categories of container yard layouts. Focusing on a layout category where rubber tired gantries are used for stacking containers, we present an integer program for designing container yard layouts. We show that an intuitive formulation of the problem can be reformulated as a special type of a resource constrained shortest path problem. Due to a problem specific cost structure instances can be solved in polynomial time. Computational results are presented for typical terminal scenarios.

2 - Solving a berth allocation problem

Serigne Gueye, Le Havre University, LMAH, 25 rue Philippe Lebon B.P. 540, 76058, Le Havre, France, serigne.gueye@univ-lehavre.fr, Sophie Michel, Adnan Yassine, Philippe Michelon

The Berth Allocation Problem (BAP) is the problem of allocating and scheduling container vessels on berths so as to minimize total weighted flow time. We study a version of BAP in which containers are moved between vessels and berth space is abundant. Thus, the problem reduces to optimally assign vessels to berths. We formulate it as a non standard Quadratic Assignment Problem. The problem is simplified, linearized, and valid inequalities is found. Numerical results are shown.

3 - From simulation to emulation — optimising container terminal operation

Holger Schuett, Optimisation and Simulation, ISL - Institute of Shipping Economics and Logistics, Barkhausenstrasse 2, D27568, Bremerhaven, Germany, schuett@isl.org

Simulation found its way from industrial to logistic applications. Automation and increasing vessel sizes led to the demand of optimizing container terminal operations. The paper will give an overview about terminal simulation (starting in the 80ies) up to emulation technology, which nowadays is used for (semi-)automated terminals needing high level Terminal Operating Systems (TOS). Device emulators are coupled to the TOS to generate a software testbed. Furthermore this systems may be used for optimising terminal processes controlled by the TOS as well as for training terminal operators.

4 - The impact of truck arrival information on container handling operations at marine terminals

Wenjuan Zhao, Department of Civil and Environmental Engineering, University of Washington, 98105, Seattle, WA, United States, wz@u.washington.edu, Anne Goodchild

Reducing container rehandling work within a container terminal improves yard crane productivity and reduces drayage truck transaction time. This paper focuses on using truck arrival information to improve import container handling operation by reducing rehandles. Simulation is used to evaluate the reduction in rehandles made possible by exploiting truck arrival information in a variety of scenarios. The research demonstrates that significant benefit can be achieved for both the terminal and truck operator with relatively small amount of information, particularly if it is updated in real-time.

TA-04
Tuesday 08:00-09:20
Lisztt
Online Scheduling and Batching
Stream: Scheduling
Invited session
Chair: Sleman Saliba, ABB Corporate Research Center Germany, Wallstadter Str. 59, 68526, Ladenburg, Germany, slemal.saliba@de.abb.com

1 - An on-line approach for solving flexible flow shop problems where jobs arrive over time

Verena Gondek, Fachbereich Mathematik, Universität Duisburg-Essen, Forsthausweg 2, LE 431, 47057, Duisburg, Germany, verena.gondek@uni-due.de

We consider a problem that arises from the workflow in a steel mill. During the whole manufacturing process, the quality of the produced steel and slack is observed in an automated laboratory. The organization of the corresponding list of operations can be classified as a flexible flow shop problem where jobs arrive over time and the objective is to minimize the total weighted completion time or flow time. Since this problem is known to be NP-hard, we deal with heuristic solution techniques and develop an approach based on dispatching rules, decomposition and bottleneck related strategies.

2 - Batch scheduling of simple linear deteriorating jobs on a single machine to minimize makespan

Min Ji, Department of Logistics and Maritime Studies, Zhejiang Gongshang University & The Hong Kong Polytechnic University, Hong Kong, jimkeen@163.com, T.C. Edwin Cheng

We consider a single-machine scheduling problem in jobs are to be processed in batches and the processing time of each job is a simple linear function of its waiting time. The objective is to minimize the makespan. We show that the general problem and some special cases are all strongly NP-hard or NP-hard. If the number of batches is B, for the case that B is not larger than U, we present an FPTAS, where U is a constant not less than 2. Furthermore, we provide an optimal linear time algorithm for the special case where the jobs are subject to a linear precedence constraint.
3 - A best possible deterministic on-line algorithm for minimizing makespan on parallel batch machines

Xiwen Lu, Dept. of Math, East China University of Science & Technology, Dept. of Math., East China University of Science & Technology, Shanghai 200237, China, 200237, Shanghai, xwhu@ecust.edu.cn, Peihai Liu, Yang Fang

On-line scheduling problem is studied on parallel batch machines. Jobs arrive over time. A batch processing machine can handle up to B jobs simultaneously and B is sufficiently large. The objective is to minimize makespan. We give the lower bound of competitive ratio of this problem. An optimal on-line algorithm is presented.

4 - Strategies for the online target date assignment problem

Sleman Saliba, ABB Corporate Research Center Germany, Wallstader Str. 59, 68526, Ladenburg. Germany, slman.saliba@de.abb.com, Sven Krumke, Elisabeth Gassner, Johannes Hatzl

The online target date assignment problem models a two-stage decision process encountered often in practice: upon arrival of a new request, an irrevocable first-stage decision must be made, while in a second stage, certain downstream problems can be solved to optimality later. We consider the case of deferral time one and unsplittable requests for a general class of downstream problems comprising many problems like routing, binpacking or scheduling. We prove a lower bound of 3/2 on the competitive ratio of any online algorithm and give an algorithm which matches the lower bound.

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3 - An immune inspired real-time detection system

Feng Ga, School of Computer Science, University of Nottingham, Jubilee Campus, Wollaton Road, NG8 1BB, Nottingham, Nottinghamshire, United Kingdom, fxg@cs.nott.ac.uk

To develop an effective real-time detection system based on the Dendritic Cell Algorithm (DCA), we propose two approaches, namely theoretical and empirical. In theoretical approach, formal methods including the Duration Calculus, Timed Automata, and PLC Automata are used. They provide the formal specification and automatic verification, as well as the mathematical foundation of the designed system. Conversely, in empirical approach, an adaptive real-time analysis component is added to the algorithm, and the newly implemented system is tested by multiple datasets for the purpose of validation.

4 - Cluster interpretation of the self-organising map

Jan Feyereisl, School of Computer Science, University of Nottingham, Jubilee Campus, Wollaton Road, NG8 1BB, Nottingham, Nottinghamshire, United Kingdom, jjf@cs.nott.ac.uk

The Self-Organising Map algorithm developed by Teuvo Kohonen is an established machine learning technique that maps high-dimensional data onto a lower-dimensional representation, while maintaining topographic properties of the input data within the output representation. We propose to exploit both the self-organisation and the topographic property of Kohonen’s algorithm in combination with a biologically inspired concept for the purpose of better cluster interpretation. This combination provides a variable-type independent expert knowledge information fusion for improved data exploration.

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1 - Fuzzy systems in breast cancer treatment decision making

Jonathan Garibaldi, Computer Science & IT, University of Nottingham, Jubilee Campus, Wollaton Road, NG8 1BB, Nottingham, United Kingdom, jmg@cs.nott.ac.uk, Xiao-Ying Wang

In this study we apply a non-stationary fuzzy system to a post-operative breast cancer treatment decision problem. The experimental results show that by applying the non-stationary fuzzy model, the overall system performance is better than purely employing a conventional type-1 fuzzy model. The results also indicate that when perturbing membership functions with a diverse standard deviation, the performance within different non-stationary fuzzy expert systems are very small. Based on this observation, a new paradigm in designing fuzzy inference systems is proposed.

2 - Assessing feasibility of a homeostatic approach to thermal management of a data centre

Naisan Benatar, School of Computer Science, University of Nottingham, Jubilee Campus, Wollaton Road, NG8 1BB, Nottingham, Nottinghamshire, United Kingdom, nxb@cs.nott.ac.uk

This presentation outlines the initial work to be used in assessing the use of a homeostatic control system for management of thermal challenges present in modern data centers. Using an agent based model to model sensors and actuators this presentation attempts to lay the ground work for a system inspired by the human glucose regulatory system and exhibits some of its characteristics such as its distributed nature and self organizational abilities. The intended result is to demonstrate that homeostatic based systems can equal or exceed current systems performance in terms of energy usage.

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1 - A mathematical model for empty container allocation

Carlos Andres, Management Department, Technological University of Valencia, Camino de Vera S/N, 46022, Valencia, Spain, candres@omp.upv.es, Salvador Furió, Belarmino Adenso-Diaz, Sebastián Lozano
Empty container management is a key issue in the maritime business nowadays. This article analyses the problem from the local maritime agent point of view, which controls and manages land container logistics. Specifically, it is presented a mathematical model to optimize land empty container movements among shippers, consignees, terminals and depots, along with minimizing storage costs. The mathematical model is defined and solved by using CPLEX. Obtained results confirm the benefits of implementing this kind of models.

2 - A vehicle routing problem with flexibility in the delivery dates: a real case
Joaquin Pacheco, Applied Economy, University of Burgos, Plaza Infanta Elena s/n, 09001, Burgos, Spain, jpmacheco@ubu.es, Alba Alvarez, Irma Garcia
The work addresses a new routing problem based in a real case. The objective is minimizing the total distance traveled for the daily routes over the week. Flexibility in the dates of delivery is introduced. The problem is a generalization of CVRP and also a particular case of the PVRP. A formulation as an integer linear problem and a method based in GRASP and PR are proposed. The method finds the optimal solution in small instances in very short time. In these instances commercial software spent much more time. Also our method performs better than recent and well-known methods for PVRP.

3 - A single machine scheduling problem with periodic maintenance and sequence-dependent setup times
Francisco R. Angel-Bello, ITES de Monterrey, 64849, Monterrey, Mexico, fangel@itesm.mx, Joaquin Pacheco, Ada Alvarez
In this paper a problem of sequencing tasks in a machine with programmed preventive maintenance and sequence-dependent set-up times is addressed. The problem has similarities with the Vehicle Routing Problem with distance constraint and asymmetric costs and represents an NP-hard problem. A solution approach based on metaheuristic procedures has been designed and implemented and the computational experiments show that it finds good solutions in reasonably short times.

4 - Modeling the reverse logistic network for the periodic collection of end-of-life appliances: a case study
Belarmino Adenso-Diaz, Engineering School at Gijon, Universidad de Oviedo, Campus de Viesques, 33204, Gijon, Spain, adenso@espg.uniovi.es, Julio Mar-Ortiz, Jose Luis Gonzalez-Velarde
We discuss a real-life case study to optimize the logistics network for the periodic collection of end-of-life appliances in the Spanish region of Galicia. A three phase hierarchical approach is considered. In the first and second phase both the reverse logistics facility location and the periodic vehicle routing problems are solved respectively (details are described in Mar-Ortiz et al., 2009). Finally, in the third phase several runs of a simulation model on the vehicle routing results are performed and analyzed to gain insight into the long-term performance of the recovery system.

5 - An axiomatic design approach for the reverse logis-tics networks design
Didem Cinar, Industrial Engineering, Istanbul Technical University, istanbul technical university management faculty, macka besiktas, 34367, istanbul, Turkey, cinard@itu.edu.tr, Ronay Ak, Y. Ilker Topcu
Reverse logistics (RL) has been increasingly researched because of growing green concerns. Reusing, recycling and remanufacturing have been considered as environmentally and financially effective processes for various drivers - government, corporations and customers. In RL literature, A significant number of articles have been written about specific aspects of RL, such as remanufacturing or recycling. This paper presents a conceptual framework for reverse logistics by the axiomatic design (AD) approach. AD can be used to design RL and distinguish objectives and means of RL for different levels.

TA-07
Tuesday 08:00-09:20
GSI - S 29
Network design & scheduling
Stream: Optimization in Public Transport
Invited session
Chair: Ernesto Cipriani, Dept. Civil Engineering, University of Roma TRE, Via Vito Volterra 62, 00146, Roma, Italy, eciprian@uniroma3.it
1 - Public transport service optimization through an analytical investigation of AVM data collection
Stefano Carrese, Department of Civil Engineering, University of Roma TRE, Via Vito Volterra 62, 00146, Roma, Italy, carrese@uniroma3.it, Sandro Bartolucci, La Spada Simone
In this paper the service optimization of public transport through an analytical investigation of AVM data will be analyzed. Transport and mathematical rules have been both combined to find two models to use the large amount of AVM data. The 2 models are based on binary and fuzzy logic. Then the 2 models have been applied to the Upper public transport service to test them. Particularly more of 80M AVM data have been used, analyzing for 6 months 11 bus lines with different characteristics. This trial test has allowed to calibrate the models and compare binary with fuzzy results.

2 - Transit network design: a procedure and an application to a large urban area
Ernesto Cipriani, Dept. Civil Engineering, University of Roma TRE, Via Vito Volterra 62, 00146, Roma, Italy, eciprian@uniroma3.it, Stefano Gori, Marco Petrelli
In the present study authors propose a transit network design procedure to deal with a large urban areas characterized by complex network topology, not obviously described as a simple radial or grid network, and the public transport system can be composed by different transit modes. This new feature allows to estimate the bus transit network in terms of main and feeder lines.

3 - The use of pricing revenues for improving public transport services
Luca D’Acierno, Dipartimento di Ingegneria dei Trasporti, Università degli Studi di Napoli “Federico II”, Via Claudio, 21, 80125, Napoli, Italy, dacierno@unina.it, Roberta Ciccarelli, Bruno Montella, Mariano Gallo
In recent years several European cities have introduced road pricing as a tool for managing transport demand, especially to reduce traffic congestion and rebalance the modal split between private vehicles and mass-transit systems. The aim of this research is to develop an optimisation model that allows fares to be calculated according to economic theory of ‘efficient tolls’ in the case of different pricing schemes (such as parking, cordon and road pricing) and analyse effects of pricing revenue reinvestments in terms of user accessibility increase and mass-transit fare reductions.
This paper deals with an evaluation of the robustness of a railway network. A network is considered robust when it reacts well to failures on links or stations. Indexes measuring the overall travel time of a network when links fail are introduced for two different cases: short interruptions and long interruptions. In the first, all lines using the failing arc are delayed, while in the second a bus between the affected stations allows the rest of the network to function properly. The implementation of those indexes in the Madrid commuter system shows their applicability.

4 - Railway network robustness and the complex network science
Juan A. Mesa, University of Seville, 41092, Sevilla, Spain, jmesa@us.es

During last two decades some research efforts have been made to understand the functioning of large and complex networks. Railway networks present some specific features that give rise to new challenges regarding measuring efficiency and robustness. In this work we discuss these issues.
In this paper we address a workforce scheduling problem in which we have to design a shift plan, containing a great number of breaks, satisfying several criteria, e.g. staffing demand, labour rules and ergonomic requirements. While most of previous research follows a two-phase approach, meaning that a shift plan is designed first and breaks are inserted afterwards, we model the entire problem and optimize it with a local-search-based solver. We present the application of our approach on real-life instances.

4 - Decision support system for planned student scheduling in a backlog supporting institute
Sanjeev Kumar Guleria, Computer Centre, Thapar University, P.B. No. 32, 147004, Patiala, Punjab, skguleria@thapar.edu, A.K. Lal, Daljit Singh Bawa

An Institute that offers the facility of backlogs to its students often finds difficulty while offering backlog subjects. The reason for this is that as a student studies subjects in junior class, his current class should be free at that time. The methodology used to create a decision support system to solve this problem is discussed. The approach has been first to do some planning like deciding the subjects which have to be scheduled in same time, next facilitate this offering while timetabling so that the backlog subjects can be scheduled easily at the time of registration.

1 - Reducing the workload of modification in small-scale staff scheduling from strategies of optimization
Takuma Kubo, The Graduate University for Advanced Studies (SOKENDAI), 2-1-2 Hitotsubashi, Chiyoda-ku, Tokyo, 101-8430, Tokyo, Japan, kubo_tk@nii.ac.jp, Takeaki Uno

On staff scheduling in small offices, users usually have to modify the schedules obtained by optimization, and this task is usually the bottleneck. For such offices customization is always too expensive, thus we thought it is quite important to make optimization method and environment which lighten this task. We had real-world experiments operated by human, and clarified that too much focused objectives, and sophisticated optimization make the solutions hard to be modified. We also developed excel based scheduling system which can reduce the workload of users without much literacy.

2 - Simulated annealing algorithm for the temporary workforce planning with firm contracts
Muhammad Al-Salamah, Systems Engineering, King Fahd University, Box 5067, KFUPM, 31261, Dhahran, Western, salamah@kfupm.edu.sa

Temporary employment is a policy frequently used to adjust the working hour capacity against fluctuating demand. Temporary workforce planning has been unnecessarily simplified to account to only periodic hiring and laying off; a company can review its workforce requirement every period and make hire-fire decisions accordingly, usually with a layoff cost. We present a more realistic temporary workforce planning modeling that assumes a firm contract, which can extend to several periods. A simulated annealing algorithm is proposed to solve the MIP model that is developed for this problem.

3 - Local search for shift and break scheduling
Nysret Musliu, Vienna University of Technology, 1040, Wien, Austria, musliu@dbai.tuwien.ac.at, Andreas Beer, Johannes Gaertner, Werner Schafhauser, Wolfgang Slany

WC2A 2AE, London, United Kingdom, b.irlenbusch@lse.ac.uk, Christine Harbring

Organizations often implement incentive schemes in which rewards depend on relative performance. We provide evidence of the influence of tournament design on two activity dimensions: productive activities and destructive ones (called sabotage). We find that (1) subjects heavily sabotage when they have the possibility to do so, (2) both activities increase with widening the wage gap, (3) for a given prize spread the output is increased by a higher fixed wage component, (4) framing the situation as a work environment or allowing for communication keeps the results largely unaffected.

1 - A multiple criteria decision aiding assignment methodology for assisted reproductive
Sara Matias, Instituto Superior Técnico, Technical University of Lisbon, Av. Rovisco Pais, 1049-001, Lisboa, Portugal, saramatias@ist.utl.pt, José Rui Figueira, Maria José Carvalho, Carlos Plancha

A Multiple Criteria Decision Aiding methodology was used to obtain a recommendation on the number of embryos to transfer in Assisted Reproductive Technology cycles. ELECTRE TRI-C method by Almeida-Dias et al. (2008) was used to sort couples into predefined ordered categories associated with the transfer of 1 to 4 embryos. The parameters were obtained with the experts and using SRF software. 53 couples from a private infertility clinic in Lisbon were used. 43 received the same transfer recommendation by both rules of the method, with 33 matching the number of embryos effectively transferred.

2 - MCDM ranking method based on a dominance measure: computational study
Antonio Jiménez, Department of Artificial Intelligence, Technical University of Madrid (UPM), Facultad de Informática, Campus de Montegancedo S/N, 28660, Boadilla del Monte, Madrid, Spain, ajimenez@fi.upm.es, Alfonso Mateos
The additive multi-attribute utility model is widely used in MCDM. However, many times it is not easy to elicit precise values for the scaling weights. Several decision rules have been proposed to select an alternative under these circumstances since weaker information is required, such as ordinal information. We propose a new approach based on an intensity of dominance measure and compare it with other existing approaches using Monte-Carlo simulation. The results show that the new approach yields more accurate results in terms of the best alternative and the overall ranking.

### 3 - Using value systems for the creation of perspective-based criteria weights

Diederik J.D. Wijnmalen, Dept. for Operational Analysis (BU2), TNO Organisation for Applied Scientific Research, P.O. Box 96864, 2509 JG, The Hague, Netherlands, diederik.wijnmalen@tno.nl

Perspectives often serve as a reference for groups when assigning weights to criteria. Each perspective should lead to a typical set of weights. Many people have difficulty being forced to imagine themselves in a particular perspective to come up with appropriate weights, leading to a meaningless average weight per criterion. We propose a participatory procedure, using morphological and cluster analysis and value assessment, for creating perspective-based criteria weights. This combines individual value systems and weights with collectively established generic clusters of value profiles.

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### TA-12

**Tuesday 08:00-09:20**

**GSI - S 18**

**Stream: Stochastic Programming**

**Invited session**

Chair: Jitka Dupacova, Probability and Math. Statistics, Charles Univ, Faculty of Math. and Physics, Sokolovska 83, CZ-18675, Prague, Czech Republic, dupacova@karlin.mff.cuni.cz

Chair: David Morton, Graduate Program in Operations Research, The University of Texas at Austin, 1 University Station, C2200, 78712-0292, Austin, TX, United States, morton@mail.utexas.edu

1 - A framework for optimization under ambiguity

David Wozabal, ISDS, University of Vienna, Bruenner Str. 72, A-1210, Vienna, Austria, david.wozabal@univie.ac.at

Stochastic programs with ambiguous distributions for the involved random variables are studied. Though the true distribution is unknown, the existence of a reference measure P enables the construction of an ambiguity set B as Kantorovich ball around P. The original problems are robustified using the measures in B. To solve the resulting infinite optimization problems, equivalent formulations as finite dimensional non-convex, semi definite problems are proposed. Finally a portfolio selection problem is studied in the proposed framework and numerical results for sample problems are reported.

2 - Interdicting smuggled nuclear material

Ned Dimitrov, Operations Research, University of Texas at Austin, 1 University Station, 78712, Austin, TX, ned.dimitrov@gmail.com, David Morton

In a smuggling event, a nuclear smuggler maximizes the probability that he smuggles material from a nuclear facility, through the transportation network, to a destination. We model the smuggler’s movements via a Markov Decision Process (MDP), where the smuggler is probabilistically operating the direction in which he moves. Our goal is to place nuclear detectors to stop the smuggler. The optimal placement decision can be viewed as hedging against the worst of a set of probability distributions, where the smuggler selects the worst distribution on paths out of those allowed by the MDP.

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### TA-13

**Tuesday 08:00-09:20**

**GSI - S 31**

**Airport and Airline Networks**

**Stream: Location Analysis**

**Invited session**

Chair: Amedeo Odoni, Operations Research Center, Massachusetts Inst. of Technology, Room 33-219, MIT, 2139, Cambridge, MA, United States, arodoni@mit.edu

Chair: Antonio Antunes, Civil Engineering Department, University of Coimbra, Polo 2, 3030-788, Coimbra, Portugal, antunes@dec.uc.pt

1 - Forecasting airline flight routing network changes under airport capacity constraints

Antony Evans, Department of Architecture, University of Cambridge, 1-5 Scroope Terrace, CB4 3AL, Cambridge, ade26@cam.ac.uk

This paper describes a model that forecasts changes in flight network routing under airport capacity constraints. The model integrates several components describing different aspects of the air transport system, including passenger demand, flight delay, and airline cost. Individual airline flight network routing is forecast by maximizing airline profit. Competition is modeled by simulating a game between airlines. The model is validated by comparing results to actual data for a network of airports in the US in 2005. The model is then applied to forecast changes in this network through 2025.

2 - A queuing model for a network of airports

Amedeo Odoni, Operations Research Center, Massachusetts Inst. of Technology, Room 33-219, MIT, 2139, Cambridge, MA, United States, arodoni@mit.edu, Nikolaos Pyrgiotis
The paper describes the Approximate Network Delays model, a stochastic and dynamic queuing model that computes delays at individual airports in a network, as well as captures the propagation of delays through this network. The AND model is a strongly enhanced version of the one originally developed by Malone and has been applied to a network of 22 of the busiest commercial airports in the United States. It offers very interesting insights on how congestion at one or more airports affects the other elements of the network. A number of ongoing further model improvements will also be discussed.

3 - An optimization model for the expansion of capacity of an airport network

Miguel Santos, Civil Engineering Department, University of Coimbra, 3030-788, Coimbra, Portugal, msantos@dec.uc.pt, Antonio Antunes, Amedeo Odoni

In this presentation we introduce an optimization model aimed at assisting air transport authorities in their expansion decisions regarding the capacity of an airport network, while complying with a given budget. Expansion actions consist of building new airports in cities with or without airport, or increasing the capacity of existing airports. The objective is to maximize the satisfaction of air travel demand within the airport network, taking into account the impact of air travel costs upon demand. The strengths and limitations of the model are illustrated through practical examples.

4 - An optimization model for the allocation of slots in an airport network

João Pita, Civil Engineering, University of Coimbra, 3030-788, Coimbra, Portugal, joaoipita@gmail.com, Antonio Antunes, Amedeo Odoni

In this presentation we introduce an optimization model to determine the number of slots to be made available for each slot planning period in the different airports of an airport network. The objective is to minimize the total socio-economic costs of satisfying the leg-based travel demand faced by the airlines operating in the network, while taking into account the capacity of the airports. The model is intended at helping air transportation authorities in the negotiation processes within which slots are allocated. The usefulness of the model is illustrated with a real-world example.
2 - Vehicle loading optimization with stochastic supply

Thierry Pironet, HEC - Management School, University of Liège, Bd. du Rectorat 7, Bat B31 Bur 2.46, B-4000, LIEGE, Belgium, thierry.pironet@ulg.ac.be, Yassen Arda, Yves Crama, David Kronus

The increased availability of information makes it possible to coordinate processes usually performed in large companies, such as production and transportation. This work investigates the vehicle loading optimization for individual orders over a multiperiod horizon when items have stochastic release dates from production and time windows are imposed at the customer plant. The loading decisions are made in order to minimize the expected cost. From the deterministic model, we develop scenario-based models for the stochastic problem and investigate the performance of various solution methods.

3 - An exact algorithm for the pickup and delivery problem with time windows

Enrico Bartolini, Department of Computer Science, University of Bologna, 40127, Bologna, Italy, ebartoli@cs.unibo.it, Roberto Baldacci, Aristide Mingozzi

This paper presents a new exact algorithm for the Pickup and Delivery Problem with Time Windows (PDPTW) based on a set partitioning-like formulation. We describe a bounding procedure to find a near optimal dual solution of its LP-relaxation. The final dual solution is used to generate a reduced problem. The reduced problem is solved by an integer programming solver if it has moderate size; otherwise it is solved by branch-and-cut-and-price. Computational results on benchmark instances show that the new method outperforms the currently best known method.

It is possible to approach vector optimization by a consequent usage of infimum and supremum in an appropriate complete lattice. The corresponding theory is in appearance very similar to the scalar optimization theory. An overview on the concepts and results is given. This includes solution concepts, existence results, duality theory and several results for linear problems.

2 - Optimality and duality for convex optimization problems with a set-valued objective

Andreas Hamel, Operations Research and Financial Engineering, Princeton University, Sherrerd Hall 224, 08544, Princeton, NJ, ahamel@princeton.edu

(1) A new solution concept for optimization problems with a set-valued objective is introduced which is related to dual variables in the images space. (2) A duality scheme is provided which produces all the results well-known in the scalar case. It is shown that this scheme yields the existence of solutions of the dual problems in the sense introduced in (1). (3) New conditions of the type “zero is in the subdifferential” and “the directional derivative is non negative” are given and shown to be as powerful as in the scalar case.

3 - Directional derivative and subdifferential for set-valued convex and proper functions

Carola Schrage, c/ Migdia 53-4-2, 08788, Vilanova del Camí, carolaschrage@web.de

A set-valued directional derivative and a subdifferential in an appropriate dual space will be defined for set-valued functions with certain convexity and properness properties using a new set-valued “order difference”. Under an additional inner point condition, the subdifferential is nonempty and a counterpart to the scalar maxformula can be shown.

4 - Set-valued optimization in mathematical finance

Frank Heyde, Institute of Mathematics, MLU Halle-Wittenberg, Theodor-Lieser-Str. 5, D-06099, Halle (Saale), Germany, heyde@mathematik.uni-halle.de, Andreas Hamel

We will apply methods of set-valued optimization to problems of mathematical finance. The focus will lie on set-valued measures of risks and its use in portfolio optimization.
2 - Mathematical model and efficient algorithm for object packing problem
Tatiana Romanova, Department of Mathematical Modeling and Optimal Design, Institute for Mechanical Engineering Problems of the National Academy of Sciences of Ukraine, 2/10 Pozharsky St., 61046, Kharkov, Ukraine, sheron@kharkov.ua, Yuri Stoyan, Nikolai Chernov

The article is devoted to mathematical models and practical algorithms for solving the cutting and packing problems. We review and further enhance the main tool of our studies phi-functions. Those are constructed here for 2D and 3D objects. We also demonstrate that in all realistic cases the phi-functions and their derivatives can be described by quite simple formulas without radicals and other complications. Lastly, a general solution strategy using the phi-functions is outlined and illustrated by several 2D and 3D examples.

3 - Optimization packing problem of equal circles
Yuri Stoyan, Department of Mathematical Modeling and Optimal Design, Institute for Mechanical Engineering Problems of the National Academy of Sciences of Ukraine, 2/10 Pozharsky St., 61046, Kharkov, Ukraine, stoyan@ipmach.kharkov.ua, Andrey Chugay

The paper considers an optimization packing problem of equal circles into a region with a finite number of prohibited areas. A frontier of the region consists of circular arcs and line segments. A mathematical model is constructed. On the ground of characteristics of the model a solution strategy is offered. The strategy consists of a combination of an algorithm of generating starting points, the feasible direction method to calculate local maxima and a modification of the decremental neighborhood method to search for an approximation to the global maximum. Numerical examples are given.

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2 - Steiner tree problems under interval uncertainty
Eduardo Álvarez-Miranda, Escuela de Ingeniería Civil Industrial, Universidad de Talca, Curicó, Merced 437, 3340000, curico, Chile, eduardo.alvimir@gmail.com, Alfredo Candia-Vejar, Nelson Maculan Filho

In this work we study the Steiner Tree (ST) Problem on Graphs under uncertainty, modeled by cost intervals in the objective function. For first time the problem is studied for both the Minmax Regret and the Robust (Bertsimas & Sim) approaches. MILP formulations with a polynomial number of variables and constraints are presented for both models based on structural properties proved valid for this problem.

The formulations are extended to model the Prize Collecting ST Problem, which is more attractive from a practical perspective when deterministic uncertainty is considered.

3 - Generalized linear fractional programming under interval uncertainty
Milan Hladík, Department of Applied Mathematics, Charles University, Faculty of Mathematics and Physics, Malostranské nam. 25, 11800, Prague, Czech Republic, milan.hladik@matfyz.cz

Data in many real-life problems suffer from inexactness. Herein we assume that we are given some intervals in which the data can simultaneously perturb. We consider a generalized linear fractional programming problem with interval data and present an efficient method for computing the range of optimal values. We consider also the inverse problem: How much can data of a real generalized linear fractional program vary such that the optimal values do not exceed some prescribed bounds. We illustrate the approach on a simple von Neumann economic growth model.

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**TA-18**

**Tuesday 08:00-09:20**

**Optimization under Uncertainty**

**Stream: Mathematical Programming**

**Invited session**

Chair: Milan Hladík, Department of Applied Mathematics, Charles University, Faculty of Mathematics and Physics, Malostranské nam. 25, 11800, Prague, Czech Republic, milan.hladik@matfyz.cz

**1 - New framework for supply chain decision making under uncertainty: an analysis of the computational effort**

Abhilasha Aswal, Infosys Technologies Limited, Bangalore, India, #26/C Electronics City, Hosur Road, 560100, Bangalore, Karnataka, India, abhilasha.aswal@iiitb.ac.in, G. N. Sriyadhas Prasanna

We present a new & intuitive approach for optimization under uncertainty, useful in supply chains. We couple convex optimization and information theory. Unique features of our work include the ability to qualitatively compare different future sets of assumptions (scenarios) using polytope geometry, and quantification of the Shannon information content in a scenario. Scenarios equivalent in information content to one another can be generated. Our optimization methods under these assumptions are fast (handle 1000’s of nodes/products in minutes on laptops), even with non-convex cost breakpoints.

**2 - A memetic algorithm for a stochastic single product network design model with lead time and safety stock considerations**

Behzad Bagheri, Department of Industrial Engineering, University of Science and Culture, Ashrafi Esfanahi Blvd, Park Street, 13145871, Tehran,
In CCR model, BCC model, additive model and SBM model, slacks are maximized. It corresponds to finding a point in the production possibility set that is the farthest point from each Decision Making Unit (DMU) to be evaluated, that is, the most difficult point to refer. We proposed the minimum distance models, which minimize a sum of slacks. The super-efficiency or SuperSBM model is similar to the minimum distance model. In this paper we propose the unified DEA model including super-efficiency measure and propose some efficiency measures.

3 - Two-stage production process in data envelopment analysis

Alireza Amirteimoori, Applied mathematics, Azad university, No. 2., Golsar, 41335-3516, Rasht, Guilan, ateimoori@iaurasht.ac.ir

In DEA we normally assume that the produced outputs are perfect. However, in many real instances, some of the products are imperfect. In this case, the system under consideration is composed of two components: main system and repair shop. The main system consumes output to produce input. The outputs of the main system may be imperfect. The imperfect outputs need to be repaired in the repair shop. In this paper we will investigate the production system that consists of two stages arranged in series, where succeeding stage is fed by a mixture of external inputs and some of the outputs of the first stage.

4 - Fuzzy bi-objective generalized data envelopment analysis

Jafar Pourmahmoud, Tabriz, 5375171379, Tabriz, pourmahmoud@azaruniv.edu

Data envelopment analysis (DEA) requires input and output data to be precisely known. This is not always the case in real applications. This work introduces a new fuzzy bi-objective generalized data envelopment analysis (F-Bi-GDEA) model and defines its efficiency. The new F-Bi-GDEA model is formulated as linear programming models and can be solved to determine fuzzy efficiencies of a group of decision-making units (DMUs).

■ TA-21

Tuesday 08:00-09:20

Hauptmann

Applications of mathematical logic

Stream: Boolean Programming

Invited session

Chair: Ondrej Cepek, Theoretical Informatics and Mathematical Logic, Charles University in Prague, Malostranske namesti 25, 11800, Praha, Czech Republic, ondrej.cepek@mff.cuni.cz

1 - On the chvatal ranks of knapsack problems

Bela Vizvari, Industrial Engineering, Eastern Mediterranean University, Gazimagusa, 10, Mersin, Turkey, vizvari.bela@gmail.com

There is a famous result of Chvatal giving a theoretical iterative procedure, which determines the integer hull of a polyhedral set. It starts from the polyhedral set itself and in each iteration new cuts are introduced. This result is considered the theory of the Gomory method of integer programming. The simplest integer programming problem is the knapsack problem. The number of iterations in Chvatal’s procedure is investigated in the case of some extremely simple binary knapsack problems. It is shown that the Chvatal rank can be high even in these cases.

2 - Recognition of positive k-interval boolean functions

David Kronus, HEC - Management School, University of Liege, Batiment B31, Rue du Rectorat 7, 4000, Liege, Belgium, dave@matfyz.cz, Ondrej Cepek
The concept of representing Boolean functions using intervals of integers has been introduced in the area of optimizing automatic data generation for software testing. Intervals of integers represent Boolean function if these intervals span just the integers having as their binary representation a truepoint of f. We introduce the original motivation and present an asymptotically optimal algorithm recognizing 1-interval and 2-interval functions. We conclude with some ideas about possible generalization of this algorithm for any number of intervals.

3 - A model for analysing microarray data using techniques of boolean functions

Petr Kucera, Faculty of Mathematics and Physics, Charles University in Prague, Na Grosi 1157/9, 10200, Praha 15, Czech Republic, kucera@ktiml.mff.cuni.cz, David Kronus, Ondrej Cepke

We address in this work a problem of discovering dependencies among gene expression levels. The problem is formulated in mathematical terms as a search for a fully defined three valued function defined on three valued variables which is partially specified by the DNA microarray measurements. We present a model, which can be used for analysing this problem and which is strongly motivated by results in the area of logical analysis of data (LAD) and in the area of partially defined Boolean functions (pdBfs).

4 - Operational use of a lad model

Louis-Philippe Kronek, Laboratoire Leibniz-IMAG, Grenoble, France, louis-philippe.kronek@imag.fr, Nadia Brauner, Sylvain Gravier, Frédéric Meunier

When delivering a LAD model to physicians, we were confronted to the following questions: (1) In which order do I have to do the exams to minimize the cost (which can be the dangerosity of the exams) for tracking a disease in a population ? (2) Which are the 3 (or k) exams that allow an efficient first selection. We compare those two questions to classical scheduling problems and derive complexity results. We also generalize the questions asking for a non dominated order of the exams. We study special cases and give algorithmical results.

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<td>Reverse Logistics: Decision models and their Industrial Applications</td>
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<td>Chair: Baptiste Lebreton, Lehrstuhl für Umweltmanagement / Prof. Tuma, Universität Augsburg, WiWi-Fakultät, Universitätstr. 16, 86159, Augsburg, Germany, <a href="mailto:bbklebr@solutia.com">bbklebr@solutia.com</a></td>
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1 - The definition and implementation of a competitive reverse logistics strategy at a plastic films manufacturer.

Baptiste Lebreton, Lehrstuhl für Umweltmanagement / Prof. Tuma, Universität Augsburg, WiWi-Fakultät, Universitätstr. 16, 86159, Augsburg, Germany, bbklebr@solutia.com

Company S, the world wide leader for the manufacturing of plastic films for the automotive and architectural glazing industry faced in 2006 the challenge of defining a reverse logistics strategy to protect its business and margins. Company’s S customers were reselling production leftovers to free-riders, thus allowing them to access the market for plastic films by reexracting the leftovers into films. The presentation documents the motivation behind the development of a product collection strategy and the optimization models used to roll out this strategy worldwide.

2 - A framework for configuration of procurement networks for secondary raw material using a hybrid system

Alexander Uffinger, University of Augsburg, Ganghoferstr. 4, 86157, Augsburg, Germany, alexander.uffinger@wiwi.uni-augsburg.de

Closed-loop Supply Chain Management is one of the most important concepts to realize a sustainable economy. Thereby the configuration of procurement networks for secondary raw materials is a key factor. The underlying decision problem can be classified as a SNP integrating a continuous location search and a technology selection. The presented framework suggests a structured procedure including a hybrid system. Thereby the hybrid system optimizes the configuration by combining a CPLEX solved MILP-formulation with a heuristic local search approach. The framework is applied to the paper industry.

3 - Reverse logistics network design: the impact of lead times and stochasticity

Kris Lieckens, University of Antwerp, Prinsstraat 13, 2000, Antwerp, kris.lieckens@ua.ac.be, Nico Vandaete

An advanced strategic decision support model is developed for the efficient design of reverse logistics networks. Queuing relationships are integrated into a facility-allocation model to allow for lead time related costs and various sources of uncertainty. This extension is important because fast delivery times are key for the success of global closed-loop supply chains while variabilities complicate their organization. Appropriate flow and capacity levels are determined for transportation and production processes. A genetic algorithm solves this problem and a case study puts it into action.

4 - A two-stage approach for collection network design and modeling reverse logistics activities in a white goods manufacturer

Tülin Aktin, Industrial Engineering Department, Istanbul Kültür University, Atatürk Campus, Bakırköy, 34156, Istanbul, Turkey, t.aktin@iku.edu.tr, Dicle Cevizci, H. Türkcan Kataaslan

Collection of used products, and product recovery requiring disposition decisions such as recycling, remanufacturing, repairing and disposal, are among the important issues for an environmentally conscious company. This study proposes a two-level optimization for modeling reverse logistics activities. The first stage aims to design a network, determining the location of collection centers and the amount of product returns. The output of this stage is fed into the second one, where disposition decisions are made. The framework is implemented in one of Turkey’s leading white goods manufacturers.

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<td>Stream: Demand, Pricing and Revenue Management</td>
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<td>Chair: Claudius Steinhardt, Mathematical Methods for Business and Economics, University of Augsburg, Universitätstraße 16, 86159, Augsburg, Germany, <a href="mailto:claudius.steinhardt@wiwi.uni-augsburg.de">claudius.steinhardt@wiwi.uni-augsburg.de</a></td>
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1 - Revenue management in a make-to-order environment with forecasting errors

André Hintsches, Institute of Automotive Management and Industrial Production, Technische Universität
2 - A dynamic bid-price approach to reduce risk in make-to-order revenue management

Kai Wittek, Institute of Automotive Management and Industrial Production, Technische Universität Braunschweig, Katharinenstr. 3, 38106, Braunschweig, Germany, k.wittek@tu-bs.de, Derya Eren Akyol, Thomas Spengler, Thomas Völling

In make-to-order revenue management, capacity control problems are typically solved by bid-prices, approximating the opportunity costs of accepting a customer order. When facing forecasting errors, this approximation becomes less accurate and the bid-price performance may deteriorate. We present a two-step dynamic bid-price approach incorporating reactive elements to exploit online demand information and analyze its robustness. Further, a risk analysis is provided. Simulation results are based on the characteristics of a make-to-order steel manufacturer.

3 - Integration of capacity control techniques and vehicle routing

Joern Schoenberger, Chair of Logistics, University of Bremen, Wilhelm-Herbst-Straße 5, 28359, Bremen, Germany, jsb@uni-bremen.de, Herbert Köpf

Accepting or rejecting transport orders is the most important decision task in operational freight transport planning. The profitability of consecutively arriving requests depends upon already accepted orders and the generated vehicle routes. In order to use the available capacities at highest efficiency, the integration of capacity control techniques seems to be promising. However, due to the high interdependencies of routed requests the allocation of capacities to a given request is hardly possible. We propose an approach to manage this challenge.

4 - Revenue management in the car rental industry: a numerical investigation of different modelling approaches

Claudius Steinhardt, Mathematical Methods for Business and Economics, University of Augsburg, Universitätstraße 16, 86159, Augsburg, Germany, claudius.steinhardt@wiiwi.uni-augsburg.de, Jochen Gönsch

Car rental companies provide different types of cars to business and leisure customers. In addition to uncertain demand to come, rental duration and return station are often spontaneously chosen and therefore not known in advance. In this talk, we present several extensions to traditional capacity control models for revenue management, coping with specific challenges like stochastic and transferable capacities, different customer segments, planned upgrades, or multiday rentals. Furthermore, we compare the performance of different approaches by a simulation study based on real-world data.
In this paper we consider market situations with two corners. One corner consists of a group of powerful agents with yes-or-no choices and clan behavior. The other corner consists of non-powerful agents with multi-choices regarding the extent at which cooperation with the clan can be achieved. The focus is on the analysis of the core of multi-choice clan games. Several characterizations of multi-choice clan games by the shape of the core are given, and the connection between the convexity of a multi-choice clan game and the stability of its core is studied.
The double travelling salesman problem with multiple stacks is a pickup and delivery problem in which all pickups must be completed before any deliveries can be made. The aim of the problem is to produce a stacking plan for the pallets in the container that minimizes the total transportation cost. The container cannot be repacked at any stage. Here we present an exact solution method based on matching k-best TSP solutions for each of the separate pickup and delivery TSP problems and show that previously unsolved instances can be solved within seconds using this approach.

4 - A hybrid simulation-optimization algorithm for the Hamiltonian cycle problem
Ali Eshragh Jahromi, School of Mathematics and Statistics, University of South Australia, School of Mathematics and Statistics, Mawson Lakes Campus, 5095, Adelaide, South Australia, Australia, Ali.EshraghJahromi@unisa.edu.au, Jerzy Filar, Michael Haythorpe

This new hybrid algorithm alters the Hamiltonian cycle problem to the travelling salesman problem. Thus, there is a stochastic matrix updated as in the Cross Entropy method and used to set a suitable linear programming model. If the solution of the latter yields any tour, the graph is Hamiltonian. Numerical results reveal that when the size of graph is small, there is a high chance to terminate the algorithm in its Cross Entropy component. However, for larger graphs, in most of the tests the algorithm terminated in its optimization component.

3 - An algorithm to find the k-clique minimum cover in an undirected graph
Luís Cavique, Universidade Aberta, Rua da Escola Politécnica 147, 1269-01, Lisboa, Portugal, lcavique@univ-ab.pt

In social network analysis, a k-clique is a related clique. A k-clique in a graph is a sub-graph where the distance between any two nodes is no greater than k. The visualization of a small number of vertices can be easy to perform in a graph; however when the number of vertices and edges increases the visualization becomes incomprehensible. In this talk, we proposed a way to obtain a general view of the graph. To find a k-clique cover in an undirected graph, firstly a large set of k-cliques is generated, and secondly the set covering heuristic is used to discover the graph cover.

TA-27
Tuesday 08:00-09:20
GSI - S 21
Knowledge Discovery and Data Mining 1
Stream: Knowledge Discovery and Data Mining
Invited session
Chair: Luís Cavique, Universidade Aberta, Rua da Escola Politécnica 147, 1269-01, Lisboa, Portugal, lcavique@univ-ab.pt

1 - Cliques of proverbial knowledge
Matthias Funk, Mathematic, University of the Azores, Rua Gonçalo, 9500, Ponta Delgada, mfunk@uac.pt

By analysing a huge inquiry we get a score matrix about the pairwise common knowledge of proverbs. By vanishing all components except the line maximums we isolate 8 oriented sub-graphs. Interpreted as (score-) layered networks we look in each layer for Cliques because they are the base of all cyclic sub-paths. We find a group of 17 structural important Cliques for the characterisation of the regional proverbial usage because each of them form a kind of local sink by the absence of any link to an affluent layer.

2 - Networks in an oral culture study: finding the region of origin for users of proverbs
Armando Mendes, Mathematics, Azores University, Rua da Mãe de Deus, 9501-801, Ponta Delgada, Azores, amendes@uac.pt, Matthias Funk, Aurora Sousa

Proverbs are a form of popular knowledge present in every culture. A project for proverbial sentences identification produced a data base with 25000 proverbs and 1000 recognition surveys. This work is aimed to extract knowledge from the data base in order to realize the influence of the locations where inquiries have been living and proverbs recognized. Link Analysis is used to highlight the more common pairs of proverbs in the network. Symbolic data tables with HCA algorithms are used to induce clusters of network nodes. The results are compared with domain knowledge, with some surprises.

TA-29
Tuesday 08:00-09:20
GSI - S 2
Computational Economics 2
Stream: Financial Modelling
Invited session
Chair: Ronald Hochreiter, Statistics and Decision Support Systems, University of Vienna, Universitaetsstrasse 5, 1010, Vienna, Austria, ronald.hochreiter@univie.ac.at

1 - Network of firms: an analysis of integrated ownership
Giulia Rotundo, Dep. of Business, Technological and Quantitative Studies, University of Tuscia, Faculty of Economics, via del Paradiso, 47, 01100, Viterbo, Italy, Italy, giulia.rotundo@uniroma1.it, Anna Maria D’Arcangelis

This paper aims to provide a network analysis of the relationships of shareholders in the Italian Stock Market for understanding the relevance of portfolio diversification in integrated ownership and firms control. The analysis combines both a complex network and an operational research approach. The former is used for statistical analyses on portfolio diversification. The latter estimates integrated ownership considering the paths on the network, and it emphasizes the difference between ownership and control. Data were retrieved through CONSOB, AIDA, BANKSCOPE and ISIS databases.
The experiments were carried out using the Insurance Company Components Analysis on Customer Database attributes selection. This paper edge extraction. So, data are preprocessed for reducing the amount of information and selecting more relevant attributes. The databases of real world contain a huge volume of information and a large quantity of data in data bases are non trivial problems during the search for 'knowledge' from these data. This paper, Visual Data Mining algorithms were used to analyze data collected from Itaipu dam. The main objective was to establish relations among variables in order to detect undesired failures in the dam security and integrity.

**TA-30**

Tuesday 08:00-09:20  
GSI - S 26  
**Knowledge Discovery for Decision Support I**  
**Contributed session**  
Chair: Maria Teresinha Arns Steinier, Mathematics, Federal University of Parana, Rua Padre Anchieta, 1231, ap. 31, 80730-000, Curitiba, Paraná, Brazil, tere@ufpr.br

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2 - **Effectiveness of the monopoly regulation on the basis of rate of return regulation**  
Michal Fendek, Department of Operations Research and Econometrics, University of Economics Bratislava, Dolnozemská cesta 1/b, 85235, Bratislava, Slovakia, Michal Fendek

Traditional methodological tool for price regulation applied by price regulators to set maximum price of network industries products is the regulation on the basis of the rate of return regulation. On the basis of the firms behavior in the conditions of regulation we show that in this regulatory scheme the monopoly has the tendency to respond to the tightening of the regulatory conditions by increasing the volume of used capital.

3 - **Application of the price regulation models in the network industries market in slovakia**  
Eleonora Fendekova, Department of Business Economics, University of Economics Bratislava, Dolnozemská cesta 1/b, 85235, Bratislava, Slovakia, fendek@euba.sk, Michal Fendek

Monopoly in modern market structure economically developed countries is acting within the legitimate market conditions and its position is determined by the real market situation. With regard to analysis of equilibrium in network industries models it is important to point out that except for competition policy protection the state fulfills another specific task — regulation of network industries. The goal of the submitted paper is to present the results of application of models for determination of maximum prices and tariffs of goods of network industries in Slovak national markets.

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2 - **Visual data mining techniques applied to Itaipu dam readings data**  
Maria Teresinha Arns Steinier, Production Engineering, UFPR, R. Pe. Anchieta, 1231 - Ap. 31, 80730-000, Curitiba, Pr. tere@ufpr.br, Pedro Steiner neto, Marco Aurelio Silva Neto, Rosangela Villwock, Sergio Scheer, Andrea Sell Dyminski  
Itaipu, the greatest hydroelectric in operation in the world, has more than 2,200 monitoring instruments, which have been storing readings in a data base for more than 30 years. Dealing with such a large quantity of data in data bases are non trivial problems during the search for 'knowledge' from these data. In this paper, Visual Data Mining algorithms were used to analyze data collected from Itaipu dam. The main objective was to establish relations among variables in order to detect undesired failures in the dam security and integrity.

3 - **Adaptive decision making by reasoning based on relevant logics**  
Jingde Cheng, Department of Information and Computer Sciences, Saitama University, 255 Shimo-Okubo, Sakura-Ku, 338-8570, Saitama, Japan, cheng@ics.saitama-u.ac.jp

We propose a new method for Decision Making: Adaptive decision making by logical reasoning based on various relevant logics. The basic idea of our adaptive decision making method is to explicitly separate the underlying logic system, reasoning/computing mechanism, and empirical knowledge in any decision making process such that both underlying logic system and empirical knowledge can be revised/replaced in various decision making processes by logical reasoning performed by an area-independent, task-independent, general-purpose reasoning mechanism.

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**TA-31**

Tuesday 08:00-09:20  
GSI - S 34  
**Strategic games**  
Stream: Noncooperative Games  
**Invited session**  
Chair: Ignacio García-Jurado, Department of Mathematics, Coruna University, Faculty of Computer Science, Campus de Elvina, 15071, Coruna, Spain, igjurado@udc.es

1 - **Protective behavior in competitive environments**  
Manuel Alfredo Mosquera Rodríguez, Statistics and Operations Research, University of Vigo, Edificio Jurídico-Empresarial, Campus Ourense, 32004, Ourense, Ourense, Spain, mamuguez@uvigo.es, Mª Gloria Fiestras-Janceiro

A two-person non-cooperative game is a competitive environment if agents show antagonistic interests. Matrix games are competitive environments. Several extensions of the class of matrix games appear in the literature. Born et al. (2009) compare these extensions with regard to their sets of Nash equilibria and protective strategy profiles. They also prove that the set of proper equilibria and the set of protective strategy profiles coincide in unilaterally competitive games. We focus on the characterization of the protective behavior in several classes of competitive environments.

2 - **Strategic absentmindedness in finitely repeated games**  
Manuel A. Pulido Cayuela, Estadística e Investigación Operativa, University of Murcia, Campus de Espinardo. Facultad de Matemáticas, 30100, Murcia, Murcia, Spain, mpulido@um.es, Ignacio
In this paper we consider finitely repeated games in which players can unilaterally commit to behave in an absentminded way in some stages of the repeated game. We prove that the standard conditions for folk theorems can be substantially relaxed when players are able to make this kind of compromises, both in the Nash and in the subgame perfect case. We also analyze the relation of our model with the repeated games with unilateral commitments studied, for instance, in García-Jurado et al. (2000).

3 - Delegation equilibrium in strategic games
Ignacio García-Jurado, Department of Mathematics, Coruna University, Faculty of Computer Science, Campus de Elvina, 15071, Coruna, Spain, igjurado@udc.es, Eyal Winter, Luciano Mendez-Naya, Jose Mendez-Naya

In this paper we introduce and analyze the concept of delegation equilibrium in strategic games. A delegation equilibrium of a strategic game is a profile that: (a) is a Nash equilibrium in a game of delegates, and (b) no player can gain by changing his delegate; a delegate being a new player with a (possibly) different utility function which can be controlled by the original player who appoints the delegate. The main result of this paper is that every finite strategic game has a delegation equilibrium.

3 - A library of agent-based artificial intelligence in anylogic modelling environment
Enrique Kremers, EIFER, Universit"at Karlsruhe, Emmy-Noether-Strasse 11, 76131, Karlsruhe, Germany, kremers@eifer.org, Pablo Viejo, Nicola Apicella

This paper presents a bibliographical review, from where a classification of artificial intelligence in agent-based models is derived. From it, elemental units for intelligent behaviour are defined. Building blocks have been modelled as a library arranged by levels of intelligence. The proposed library allows a customized combination of those elements, allowing customized agents to be rapidly and easily assembled. Depending on the complexity of each agent, the library can be used for the development of behaviours through decision-making involving memory or strategic planning.
In this paper we present the theory and practical aspects of implementing the path following interior point methods for linear optimization LP-IPM, based on kernel function. We will investigate the influence of the choice of the kernel function on the computational behavior of the generic primal-dual algorithm for Linear Optimization. We find that the finite kernel function gives the best results for more than 50 percent of the tested problems.

3 - An infinite version of Farkas’ lemma and infinite linear programming on a purely linear-algebraic basis

David Bartl, Department of Mathematics, University of Ostrava, 30.dubna 22, 701 03, Ostrava, Czech Republic, bartl@osu.cz

We shall report an infinite version of Farkas’ Lemma. The Lemma involves an infinite number of linear constraints and is formulated in an infinite-dimensional vector space where no additional structure, such as topology, is assumed. We shall also report the corresponding Duality Theorem for infinite linear programming. Though the results can be formulated in the setting of two vector spaces over a common (possibly skew) field with linear ordering, one of the two spaces being linearly ordered too, we shall present only the real case of the results for clarity and simplicity.

3 - Model selection using inductively generated set

Vadim Strijov, Computing Center of the Russian Academy of Sciences, Klara Zetkin 13-79A, 127299, Moscow, Russian Federation, strijov@ccas.ru

Model selection is one of the most important subjects of Machine learning. An algorithm of model selection depends on the class of models and on the investigated problems. In the lecture the problems of regression analysis will be observed. Linear as well as nonlinear regression models will be considered. The models are supposed to be inductively generated during the selection process. Properties of Lars, Optimal brain surgery and Bayesian coherent inference algorithms will be analyzed in the light of model selection.

3 - Comparing four methods of handling missing data

Jastini Janil, Operation and Information Management, School of Management, University of Bradford, Emm Lane, BD9 4JL, Bradford, England, United Kingdom, jbmohdj1@bradford.ac.uk, James Wallace

The main objective of this work is to bring up in discussion a problem that could affect the quality of estimators and the validation of the models- the missing data. The techniques used for comparison are expectation maximization (EM), mean substitution (MS), regression imputation (RI) and case wise (CW). To make the comparison, this issue will be applied to a Customer Satisfaction Models (CSM) using data taken from previous research. Overall, it was concluded that EM is the best method to be adopted in case of missing data completely at random.

3 - Supporting problem structuring by quantitative techniques in the case of regional forest programmes

Pekka Leskinen, Research Programme for Production and Consumption, Finnish Environment Institute, Joensuu, Finland, pekka.leskinen@ymparisto.fi

In Finland, regional forest programmes promote forest policy in privately owned forests. The decision problem is complex and several, mutually incoherent problem definitions can be used. Various quantitative techniques can be utilized to support problem structuring. We consider so-called Q-method and compare its characteristics to the well-known Likert-scale when assessing stakeholders’ opinions towards regional forest policy. We consider also Cognitive Mapping and provide some ideas of how the emerged policy options can be further prioritized by statistical simulation techniques.

3 - Top-down and bottom-up - combining soft and hard methods in the hierarchical planning of state-owned forests

Teppo Hujala, Department of Forest Resource Management, University of Helsinki, P.O. Box 27, FI-00014, University of Helsinki, Finland, Teppo.Hujala@helsinki.fi, Mikko Korttila, Veikko Hiltunen, Annika Kangas, Joumi Pykäläinen, Pekka Leskinen

State forests produce multiple benefits for the society. Participative planning in these forests is a common practice at local levels. Problems may arise when the plans of separate local planning processes are summed up because the result should correspond to national aims. Is it possible to combine meaningfully local, more discursive planning process and the national budget allocation-type decision problems? This presentation responds to the evident need of mixing decision aid methods by illustrating how hierarchical planning might be resolved via hardening the soft and/or softening the hard.

3 - Mapping indicator models: from intuitive problem structuring to quantified decision making in sustainable forest management

Harald Vacik, Department of Forest and Soil Sciences, Institute of Silviculture, Peter Jordanstr. 82, A-1190,
A Cognitive mapping (CM) approach is used for structuring indicator models in sustainable forest management. Different maps are derived based on existing sustainability concepts. For the analysis of management alternatives we employ the Analytic Network Process (ANP) which takes into account the structure of the indicator maps formed. We test the hypothesis that in a joint application the centrality within CM corresponds to cumulative eigenvalue-based priorities of indicators in the ANP. The benefits and implications of combining qualitative and quantitative decision analysis are discussed.

1 - The optimization of an airline check-in area

Nico Vandaele, Faculty of Applied Economics, University of Antwerp, Prinsstraat 13, 2000, Antwerp, Belgium, nico.vandaele@ua.ac.be, Kris Lieckens

Airline companies are not only pushed to low cost operation, but they also have to comply with service level agreements. To this end, a dynamic queueing based decision tool is constructed which enables them to determine the optimal number of check-in desks, taking into account flight schedules, estimated number of booked seats and explicit constraints on customer performance requirements. As passengers proceed through the airport, issues like queue lengths and waiting times may contribute to a positive experience. It is an integer, non-linear problem that is optimized by a genetic algorithm.

2 - Appointment-driven queueing systems

Stefan Creemers, K.U.Leuven, 3000, Leuven, Belgium, stefan.creemers@econ.kuleuven.be, Marc Lambrecht

Many service systems are appointment-driven. In such systems, customers make an appointment and join an external queue (the "waiting list"). At the appointed date, the customer arrives at the facility, joins an internal queue and receives service during a service session. Afterwards, he leaves the system. Important measures of interest include the size of the waiting list, the waiting time at the service facility, server idle time and server overtime. These performance measures may support strategic decision making concerning service facility, server idle time and server overtime. These performance measures may support strategic decision making concerning service facilities, server idle time and server overtime.

3 - Delay optimization by queueing and simulation

Nico van Dijk, Quantitative Economics, University of Amsterdam, Roetersstraat 11, 1018 WB, Amsterdam, Netherlands, N.M.vanDijk@uva.nl, Erik van der Sluis

Should we pool or not? First, an instructive example is addressed of two parallel queues. It already shows the necessary and fruitful combination of queueing and simulation. Next, the combined approach is also shown to be fruitful for practical optimization of call centers and MRI scans.

4 - A survey of literature for an efficient planning of operating theater

Arnould Hansen, 151 chaussée de Binche, 7000, Mons, arnould.hansen@ucam.ac.be, Nadine Meskens

The scheduling of operating theater is critical for an efficient management of hospital. So it is not surprising to notice that the literature of the domain abounds in approaches based on mathematical models and metaheuristics. Therefore, in this paper our aim is to describe what we have observed as human (preferences, skills) and materials (availability of resources) constraints in the scheduling of operating theatre in Belgian hospitals. After that we compare with the literature and look what the others researched took into account as constraints to resolve this scheduling problem.
Combined DEMATEL technique with VIKOR method was developed to solve MCDM problems for multi-criteria optimization of complex systems. It was multi-criteria with the network relationship map, dependence and feedback, conflicting and non-commensurable among criteria, assuming that compromising is acceptable for conflict resolution, the decision-maker wants a solution that is the closest to the ideal/aspiration solution and the alternatives are evaluated according to all established criteria. Therefore, this study proposes a novel model for improving environment watershed plan strategy.

4 - Characterization of solutions in multiobjective programming under weak invexity

Hachen Slimani, Laboratory of Modelling and Optimization of Systems LAMOS, Operational Research Department, University of Bejaia, 06000, Bejaia, Algeria, haslilami@gmail.com, Mohammed Said Radjef

Every vector Kuhn-Tucker (Fritz-John) point is weakly efficient or efficient for a constrained multiobjective programming has characterized by different kinds of invex functions, see Osuna et al. 1999 and Arana et al. 2008. In this paper, we study Fritz-John type optimality for multiobjective problems and we characterize the weakly efficient and efficient solutions by using a new concept of generalized vector Fritz-John point and new kinds of invex functions.

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**TA-38**

Tuesday 08:00-09:20

GSI - S 13

**Mathematical Programs with Equilibrium Problems**

Stream: Variational Inequalities and Bi-Level Problems

*Invited session*

Chair: Jiri Outrata, Dep. of decision-making theory, UTIA Prague, Pod vodarenskou vezi 4, 18208, Praha 8, Czech Republic, outrata@utia.cas.cz

1 - Lifting mpccs

Oliver Stein, Faculty of Economics and Business Engineering, University of Karlsruhe, Institute of OR, 76128, Karlsruhe, Germany, stein@wior.uni-karlsruhe.de

We present a new smoothing approach for MPCCs, based on the orthogonal projection of a smooth manifold. We study regularity of the lifted feasible set and introduce a novel concept of lifting stability. A correspondence between the C-index in the original problem and the quadratic index in the lifted problem is shown. In particular, a local minimizer of the MPCC may numerically be found by minimizing the lifted, smooth problem. We report preliminary computational experience.

2 - On stationarity in a class of mpccs/epecs

Jiri Outrata, Dep. of decision-making theory, UTIA Prague, Pod vodarenskou vezi 4, 18208, Praha 8, Czech Republic, outrata@utia.cas.cz

Under the assumption that the equilibrium constraint defines a locally unique and Lipschitz control-to-state map S, the M- and S-stationarity conditions for a corresponding MPEC will be presented. Then we consider equilibria governed by (control-dependent) variational inequalities and investigate several situations in which the regular normal cone to the overall constraint system (including possible control constraints) can be computed. All these statements are based on the directional differentiability of S and lead to strong stationarity conditions for the respective MPEC/EPEC.

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3 - On stationarity conditions for an equilibrium problem with equilibrium constraints from an electricity spot market model

Henrion Rene, Weierstrass Institute for Applied Analysis and Stochastics, Mohrenstr. 39, 10117, Berlin, Germany, henrion@wias-berlin.de, Jiri Outrata, Thomas Surowiec

We investigate a specific equilibrium problem with equilibrium constraints (EPEC). After presenting the so-called ISO-regulated electricity spot market model, we discuss some important structural properties like strong regularity or calmness. These are later used to derive (strong or Mordukhovich-) stationarity conditions for the EPEC using a general approach developed in the preceding talk by J. Outrata. We are particularly interested in identifying situations when some of the competitors are driven away from the market.

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**TA-39**

Tuesday 08:00-09:20

GSI - S 14

**BANK MANAGER’S PERFORMANCE EVALUATION**

Stream: Operational Research and Quantitative Models in Banking

*Invited session*

Chair: David Pla-Santamaria, Alcoy School, Technical University of Valencia, 03801, Alcoy, Spain, dplasan@esp.upv.es

Chair: Enrique Ballestero, Escuela Politecnica Superior de Alcoy, Technical University of Valencia, 03801, Alcoy (Alicante), Spain, eballe@esp.upv.es

1 - Evaluating deposit performance in bank offices

Ana Garcia-bernabeu, TECHNICAL UNIVERSITY OF VALENCIA, 03801, ALCOY, Spain, angarbet@esp.upv.es, Ignacio Gonzalez

Measuring deposit performance is viewed as a multicriteria problem of comparing outputs to inputs to determine a performance score for each bank office. Outputs are net inflows of deposits while inputs are debts from deposits of different expiry dates. Both are measured as net present values from a set of discount rates, given uncertainty about the true rate to be used. The scores are computed by Single Price Model with the following advantages: (a) every bank office is scored by one index, which generally differs from the other bank offices; (b) no upper limit is assumed.

2 - Evaluating fund manager’s performance

David Pla-Santamaria, Alcoy School, Technical University of Valencia, 03801, Alcoy, Spain, dplasan@esp.upv.es, Lirios Jordi

We rank a wide set of funds from their performance, which leads to evaluate fund manager’s ability. For this purpose, a multicriteria decision model under uncertainty is used from a moderate pessimism perspective. This involves considering several states of nature from different risk measures, each state being associated with composite measures of profitability and safety. The approach is applied to evaluate fund manager’s performance for a number of funds offered by La Caixa bank in Spain. Numerical tables are provided with data, computational process and results, which are analysed.
3 - Evaluating loan performance in bank offices
Mila Bravo, ALCAY SCHOOL, TECHNICAL UNIVERSITY OF VALENCIA, 03801, ALCAY, Spain, mibrasel@epsaa.upv.es
To objectively determine performance scores of loans managed by bank offices, a multicriteria approach to output aggregation under uncertainty from a moderate pessimism perspective is used. The outputs are defined to describe net present values with different discount rates, as the true rate to be used is uncertain. The approach allows us to assign one different score to every bank office, so that loan performance for each unit is perfectly determined. Numerical data from a set of offices, as well as the computing process and results are tabulated and analysed.

4 - X-efficiency of Russian commercial banks
Veronika Belousova, Banking Department, SU-HSE, 20, Myasnitskaya, St Petersburg — University Higher School of Economics, Banking Department, 101000, Moscow, nica.belousova@gmail.com
The paper aims at X-efficiency assessment of Russian commercial banks into homogeneous groups like Fiorentino et al. (2006). The literature on Russian banks X-efficiency estimation is very scarred [Yildirim & Philippatos (2002), Fries & Taci (2005), Styrin (2005), Golovan et al. (2008), Alekseev et al. (2008), Karas et al. (2008)]. The Russian banks are very heterogeneous [Styrin (2005)]. So, two different methodologies for homogeneous group identification are presented here. SFA, taking account banks’ risk profile and tradition indicators method are applied.

■ TA-40
Tuesday 08:00-09:20
GSI - S 27
Healthcare Management in Asian Countries
Stream: OR for Development and Developing Countries
Invited session
Chair: Gerhard-Wilhelm Weber, Institute of Applied Mathematics, Middle East Technical University, ODTÜ, 06531, Ankara, Turkey, gweber@metu.edu.tr
Chair: Honora Smith, School of Mathematics, University of Southampton, Highfield, SO17 1BJ, Southampton, Hampshire, United Kingdom, honora.smith@soton.ac.uk

1 - A study on waiting time of emergency department services’ delivery of ayatollah kashani hospital of isfahan, Iran by simulation
Sima Ajami, Medical Records & Health Management & Economics Research Center, college of Management & Medical Informatics, P.O.Box: 81745-346, Isfahan, Iran, The Isfahan Medical Sciences University-hezarjarib St-Esfahan Iran, 81655-639, Isfahan, Isfahan, Iran, Islamic Republic Of; ajami@mg.mui.ac.ir, Saeedeh Ketabi, M.Hossein Yarmohammadian, Hosain Bagherian
Emergency department in Hospitals provide urgent clinical and Para clinical care for patients. The aim of this research was determining waiting time of emergency department services’ delivery of Ayatollah Kashani Hospital of Isfahan, Iran. This study was a cross-sectional. Data collected from forms. Population concluded the patients. For analyzing SPSS and Simulation used. Results showed the alternative 15 makes patient waiting time reduce from 112.19 minutes to 99.24 minutes. Physicians need simple tools for logical decision-making.

2 - Application of fuzzy set theory and topsis on healthcare failure mode and effects analysis- security of drugs in outpatient services as examples
Chang-tzu Chiang, Department of Business Administration, Yuanei University, No. 306, Yuanei St., 30015, Hsin Chu, Taiwan, ctcamber@mail.ypu.edu.tw, Chin-Tsai Lin, Li-Ping Huang
The quality of health care is getting more importance in these days, and most of medical organization had established specific department or driven related policies on it, and the most important issue which related was safety of patients. In this study Fuzzy set theory and TOPSIS were used in Healthcare Failure Mode and Effects Analysis (HFMEA) in process of dose designation, and tried to gain the important risk factors. The result of this study can be references when hospital managing Security of Drugs in Outpatient Service the safety of patients.

3 - Research on application of ccr and ccgss model to efficiency evaluation in navy health organization
Xiaorong Liu, Xiangyin Road 800,Shanghai,China, 2004433, Shanghai, China, gingri212@yahoo.com.cn
DEA is a linear method that could be used to maximize a service unit’s efficiency. We collected data from 11 Chinese navy health organizations in the period from 2001 to 2003. The C2GS2 model was only used to measure technical efficiency, while the C2R model to both technical and scale efficiency/the overall efficiency. More than 60% of the organizations were technically efficient in the three years, but 82% of them were overall inefficient, which was acquired in the C2R model. After getting the results, we conclude that navy health organizations in China had to reduce the cost.

4 - Malaysian boarding school menu planning using genetic algorithm approach
Siti Noor Asyikin Razali, Department of Statistic, Universiti Tun Hussein Onn Malaysia, Centre of Science Study, 86400 Parit Raja, Batu Pahat, Johor, 06, Johor, Batu Pahat, Malaysia, noor_syikin03@yahoo.com
Serving healthier meals at the optimize budget given by government is the stated objective of menu planner in boarding school. But, planning nutritious menu by manual calculation is tedious and time-consuming. Therefore, this study aims to develop a mathematical model to create nutritious meals specifically for Malaysian boarding schools children aged 13 to 18 years old. Genetic algorithm is applied to determine the most palatable meals that consider Recommended Nutrient Intake, variety, cost, and the budget of menu items. This solution is then compared with integer programming approach.

■ TA-41
Tuesday 08:00-09:20
GSI - S 28
OR in Agriculture I
Stream: OR in Agriculture and Forest Management
Invited session
Chair: Marcela Gonzalez, Departamento de Modelacion y Gestión Industrial, Universidad de Talca, Merced 437, s/n, Curico, Región del Maule, Chile, mgonzalez@utalca.cl

1 - Modeling farmers’ behavior using the cumulative prospect theory
Luis Coelho, Departamento de Gestao, Universidade de Evora, Largos dos Colegias, 7000, Evora, Portugal,
This paper proposes a modeling approach to evaluate the impact of economic policies on the decision maker’s behavior. This modeling approach incorporates a careful modeling of the agent’s preferences under risk into a discrete sequential stochastic programming model that describes the uncertainties and constraints faced by the decision maker. Preferences are assumed to follow the Cumulative Prospect Theory. Through utility elicitation methods we estimate the decision maker’s functions which constitute the objective function of our model. Our model was applied to nine farmers of Portugal.

2 - Dynamic reserve selection: modeling the land price feedback effect in strategic land retentions in western Washington, united states

Sandor Toth, College of Forest Resources, University of Washington, Seattle, Box 352100, 98195, Seattle, WA, United States, toths@u.washington.edu, Robert Haight, Lake Rogers
Urban growth typically compromises open space due to real estate and commercial developments. The resulting loss of ecosystem functions triggered extensive retention efforts. The reserve selection models built to aid these efforts mostly assumed that conservation has no impact on land prices and conversion risks outside the reserves— an assumption that does not hold in localized land markets. A novel, integer programming model will be presented that relaxes this assumption. The mechanics of the approach will be illustrated in real land retention contexts in western Washington, United States.

3 - A decision support system based on data envelopment analysis for improving the production process of an apple packing

Marcela Gonzalez, Departamento de Modelación y Gestión Industrial, Universidad de Talca, Merced 437, s/n, Curicó, Región del Maule, Chile, mgonzalez@usalca.cl, Jonathan Rojas
A decision support system based on Data Envelopment Analysis is developed for improving resources allocation and workers distribution in each stage of the production process of an apple packing, considering apple variety and fruit quality. Implementation of the decision support system has allowed to increase productivity in approximately 20 percent and to reduce processed fruit costs in around 19 percent.

2 - Dynamic analysis and the longterm behavior of economies

Jürgen Kremer, FB Mathematik und Technik, FH Koblenz RheinAhrCampus Remagen, Südallee 2, 53424, Remagen, Germany, kremer@rheinahrcampus.de
In this talk the chronological development of a macroeconomic model over several time periods is simulated and analysed. It turns out that, under standard assumptions, the economies that are modelled and investigated become unstable in the long term, with the interest rate in the capital market being the crucial causal factor. These presented models not only explain a range of crucial observable macroeconomic effects, such as rising unemployment, falling wages and increasingly unequal wealth distribution; they also offer the basis for a solution.

2 - Dynamic analysis and the longterm behavior of economies

Jürgen Kremer, FB Mathematik und Technik, FH Koblenz RheinAhrCampus Remagen, Südallee 2, 53424, Remagen, Germany, kremer@rheinahrcampus.de
In this talk the chronological development of a macroeconomic model over several time periods is simulated and analysed. It turns out that, under standard assumptions, the economies that are modelled and investigated become unstable in the long term, with the interest rate in the capital market being the crucial causal factor. These presented models not only explain a range of crucial observable macroeconomic effects, such as rising unemployment, falling wages and increasingly unequal wealth distribution; they also offer the basis for a solution.

Alternative Modelling in Macroeconomics

Stream: Mathematical Models in Macroeconomics

Chair: Rudolf Tröster, Electrical&Computer Engineering, Hochschule Furtwangen, 78120 Furtwangen, 79219, Staufen, Germany, troester@hs-furtwangen.de

1 - Modelling a credit crunch in a pure credit economy

Steve Keen, University of Western Sydney, NSW 1797, Sydney, New South Wales, Australia, S.Keen@uws.edu.au
I present a model of a pure credit economy in which there is a sudden change of financial flow parameters. The sudden change causes a collapse in money in circulation that reverses economic growth and causes a severe Depression. I use a new and very simple methodology for the construction of dynamic models in economics.
In deregulated electricity markets, power producers use the well known unit commitment problem to decide the operating conditions of their plants. Typically, the problem is solved on time intervals of 1 hour and time horizon of 24 hours. To make strategic decisions, the main Danish producer asked us to solve a one year production plan including cogeneration plants and yearly biomass consumption regulations. This leads to a long term unit commitment problem to be solved very fast. We studied heuristic methods that combine mixed integer programming, dispatchers and stochastic local search.

4 - Fuzzy hierarchy integral analytic expert decision process in evaluating foreign investment entry-mode selection of bio-tech firms

Hsu-Hua Lee, Graduate Institute of Management Sciences, Tamkang University, Ying-chuan Road Tamsui , Taipei County Taiwan 25137, Republic of China, 251, Taipei County, 132576@mail.tku.edu.tw, Tsau-Tang Yang, Chie-Bein Chen, Yen-lin Chen

The purpose of this study is to aid the bio-tech firms solving the foreign investment entry mode selection problem. The research findings are: (1) In the different investment entry modes, there's pretty large difference of evaluation focus while the investors select their entry modes. (2) The merge and acquisitions is the priority considered, and the following is the strategic alliances. The high stock share holding investing mode is priority if the stock share holding is unlimited. (3) The constructs of capital and risk and technology ability have the consist effect of the entry mode selecting. We establish a time series of the UK’s carbon footprint using a global, multi-regional input-output (MRIO) framework. We capture variations of underlying data and calculation procedures by modelling random, stochastic variation of the whole MRIO system, and by using Monte-Carlo techniques. 5000 Monte-Carlo simulation runs were carried out, and from these the standard deviations of components of the UK’s carbon footprint were estimated using error propagation. We find that the UK’s carbon footprint has decreased over the past decade, and that this result is statistically significant.

2 - Confronting the uncertainties in life-cycle impact assessment comparisons

Thomas McKone, School of Public Health, University of California, 50 University Hall MS7360, 94720-7360, Berkeley, California, United States, temckone@lbl.gov

Life-cycle impact assessment (LCIA) strives to compare one or more impacts in order to inform product choice. The first, first and consistency of decisions and policies based on LCIA are diminished by a failure to confront and communicate the inherent uncertainties. Multiple sources of uncertainty arise in any impact assessment, but are particularly problematic for comparisons. This presentation provides a detailed case study with biodiesel life-cycle emissions in order to explore and evaluate how uncertainty can impact decisions and how uncertainty can be addressed in life-cycle comparisons.

3 - Towards consistent management of uncertainties in life cycle assessment

Ralph Rosenbaum, Chemical Engineering, CIRAIG, Ecole Polytechnique de Montreal, 2900 Edouard-Montpetit, P.O. Box 6079, Stn. Centre-ville, H3C 3A7, Montreal, Quebec, Canada, ralph.rosenbaum@polymtl.ca, Andreas Ciroth, Fausto Freire, Reinout Heijungs, Jinglan Hong, Olivier Jolliet, Manfred Lenzen, Thomas McKone

Although essential for a confident decision, uncertainty in life cycle assessment (LCA) is usually omitted due to lacking methodological guidance and information. The UNEP/SETAC working group on uncertainty in LCA aims to facilitate management of uncertainty in comparative studies. Its focus is the development of a framework for modelling, estimation, communication and interpretation of uncertainty in LCA, ultimately aiming to establish recommended practice and guidance for both practitioners and method developers. This talk will present activities and first results of this working group.

4 - Flaws and structures in ecoinvent data: towards a quality assurance and maintenance suite

Andreas Ciroth, GreenDeltaTC GmbH, Rammerstrasse 7, 10437, Berlin, ciroth@greendeltatec.com

For the complete ecoinvent database, an extensive data analysis was carried out. A broad variety of tools and techniques was investigated in how far they can support three main goals: First, find possible flaws in data; second, find structures inherent in data and classify data in groups and subgroups according to these; and third, find useful combinations of tools for LCA data quality assurance and maintenance. The presentation will propose an ‘arrangement’ of different tools and techniques, for an overall quality assurance of ecoinvent data in an open source software suite.

5 - An intelligent system for estimating a large-size matrix in environmental accounting

Ting Yu, University of Sydney, Room 408, Physics Building A28, 2020, University of Sydney, NSW, Australia, yuting_sz@yahoo.com, Manfred Lenzen
This paper presents a data mining system being capable of automatically estimating and updating a large-size input-output matrix for Environmental Input-Output Life Cycle Assessment (EIO-LCA). The balancing and reconciliation of this matrix is carried out using information on data uncertainty.

TA-45
Tuesday 08:00-09:20
GSI - S 33
I : Societal Complexity and Safety
Stream: Methodology of Societal Complexity
Invited session
Chair: Ludmilla Koshlai, Systems analysis and OR, Institute of Cybernetics, Gonchar str., 65-a, apt.20, 01054, Kiev, Ukraine, koshlai@ukr.net

1 - Operations research techniques of rare use and catastrophes.
Maria J. García G., Gerencia General, Minimax Consultores, C.A., Torre Credicar, PB, Local M3, Chacaito, Caracas Venezuela, 78239, Caracas, 1074, Miranda, Venezuela, Minimaxconsultores@yahoo.com, José G. Hernández R.

The contribution of this work is to present some Operations Research techniques, rarely highlighted in the literature and that could be of great help to the communities confronting a catastrophe. Therefore, the objective of the work are: To describe the use of: Fuzzy set theory; Decreasing digits; A, B, C, Model; Structure of decision trees; Multiattribute Models (MM) with multiplicative factors and Matrixes Of Weighing (MOW) to construct systems of support that help in case of catastrophes. Key words: Catastrophes, Decision trees, Multiattribute Models, Matrixes Of Weighing.

2 - A proposal of primal and dual problems in macroeconomics
Eizo Kinoshita, urban sicience, Meijo University, 4-3-3,nijigaoka, 509-0261, kani, gifu, Japan, kinoshit@urban.meijo-u.ac.jp

While the prolonged recession Japan has experienced during the last fifteen years, and the global downfall in stock prices triggered by the 2008 US sub-prime loan crisis, both adversely affected general consumers, the two events also presented significant difficulties within the study of economics. Macro-economics was born from the Great Depression, a prolonged slump that originated in the US eighty years ago. It is the position of this paper that Japan’s recession and the US sub-prime loan crisis have revealed a new fundamental economic truth.

3 - Credit crisis and global safety
Dorien DeTombe, Methodology of Societal Complexity, Chair Euro Working Group, P.O.Box 3286, 1001 AB , Amsterdam, Netherlands, detombe@nosmo.nl

The credit crisis is a complex societal problem in which many phenomena, people and actors are involved. Analyzing the causes, stabilizing the financial system and preventing a new fall back needs a multi-disciplinary analysis. Theories of many disciplines should be used to analyze this issue and to make decisions. This can be done by the Compram methodology (DeTombe). The Compram methodology is specialized to handle complex interdisciplinary worldwide problems and offers for politicians a step-by-step approach of analyzing the problem and finding and implementing sustainable decisions.

4 - Modeling of large city problems under credit crisis
Ludmilla Koshlai, Systems analysis and OR, Institute of Cybernetics, Gonchar str., 65-a, apt.20, 01054, Kiev, Ukraine, koshlai@ukr.net, Mikhail Mikhailevich

The consequences of global crisis are difficult for countries in transition. The interaction of crisis and inadequate development of infrastructure has generated a number of interrelated problems, which concentrate within the suburban area of large cities. In essence, these problems are typical examples of complex societal problems and Compram method are applied for their solution. The classification of areas in city and its suburbs play the important role for Compram sub-cycles; methods of fuzzy set theory, ordinary regression and hierarchy analysis are applied for these purposes.
Tuesday 09:35-11:05

TB-01
Tuesday 09:35-11:05

Beethoven

Keynote T1
Stream: Keynote Talks

Keynote session
Chair: Michel Gendreau, CIRRELT, Université de Montréal, C.P. 6128, succ. Centre-ville, H3C 3J7, Montreal, Quebec, Canada, michelg@crt.umontreal.ca
Chair: Erwin Pesch, FB 5, University of Siegen, Hoelderlinstr. 3, 57068, Siegen, Germany, erwin.pesch@uni-siegen.de

1 - Google’s auction for tv ads
Noam Nisan, School of Computer Science and Engineering, Hebrew University, 91904, Jerusalem, Israel, noam.nisan@gmail.com

The talk will describe the auction system used by Google for allocation and pricing of TV ads. The auction is based on a simultaneous ascending auction, and has been in use since September 2008.

2 - Airport OR
Ulrich Dorndorf, INFORM GmbH, Pascalstr. 23, 52076, Aachen, Germany, udorndorf@acm.org

Airports are increasingly seen as future bottlenecks of the air transport system. Airport and Aircraft Operators, Ground Handling companies and Air Traffic Service Providers are under pressure to improve operational efficiency, predictability and on-time performance.

Airport Operations lead to a number of challenging optimisation problems. The goals are to enhance the use of ground handling resources, to optimise the use of airport infrastructure from runways and taxiways to apron and terminal resources such as stands, gates or check-in counters, to reduce ground movement costs, as well as to reduce Air Traffic Flow Management slot wastage. Problems arise at the planning and at online control level, where the task is complicated by frequent changes of the flight schedule.

We give an overview of Airport OR applications and illustrate it by example problems for scheduling terminal and ground handling resources.

We conclude with current trends in airport applications. Airport OR has traditionally been concerned with the optimisation of individual, local processes. Airports and airlines are beginning to set up Airport (Hub) Operations Control Centers to obtain an overall view of their operations, especially of the aircraft turn-around processes. Airport Collaborative Decision Making (A-CDM) takes this one step further by providing an integrated view of all processes from arrival and departure sequencing, surface movement to turn-around management. The Total Airport Management (TAM) concept extends A-CDM by including passenger processes on the landside.

TB-02
Tuesday 09:35-11:05

Schumann

Keynote T2
Stream: Keynote Talks

Keynote session
Chair: Ulrike Leopold-Wildburger, Statistics and Operations Research, Karl-Franzens-University, Universitätsstraße 15/E3, 8010, Graz, Austria, ulrike.leopold@uni-graz.at

TB-03
Tuesday 09:35-11:05

Reger

Keynote T3
Stream: Keynote Talks

Keynote session
Chair: Peter Letmathe, Chair of Value Chain Management, University of Siegen, Hoelderlinstr. 3, 57076, Siegen, peter.letmathe@uni-siegen.de
Chair: Roman Slowinski, Institute of Computing Science, Poznan University of Technology, Laboratory of Intelligent Decision Support Systems, Street Piotrowo 2, 60-965, Poznan, Poland, roman.slowinski@cs.put.poznan.pl

1 - Assignment problems
Rainer Burkard, Institute of Optimization and Discrete Mathematics, Graz University of Technology, Steyrergasse 30, A-8010 Graz / Austria, Graz, Austria, burkard@tugraz.at

Assignment problems (AP) are classical OR problems which occur in many applications. This lecture will not only outline recent results concerning the history of AP, but will also discuss novel applications, new findings concerning the probabilistic behaviour of AP and a framework for deriving bounds in a very general setting. Namely:

New findings show that linear assignment problems can be traced back to the mathematics of the 19th century.

Bob Machol stated that linear assignment problems have only very few genuine applications. We outline new applications related to the origin of our universe as well as to problems in geometry.

In 1969 Donath conjectured the expected optimal value of a linear AP with random cost coefficients in [0,1]. More than 30 years later this conjecture has been verified by Aldous. Aldous’ theorem gave the impulse for interesting new investigations on random AP.

Finally we outline the concept of admissible transformations which allows to treat sum and bottleneck problems from a unified viewpoint. Many bounding schemes for quadratic and multi-index AP can be formulated within this framework.

2 - Conic programming relaxations for combinatorial optimization
Franz Rendl, Institut fuer Mathematik, Universitaetsstr. 65, 9020, Klagenfurt, franz.reendl@uni-kl.ac.at

The success of interior point methods in the 1990’s to solve semidefinite programs (SDP) has spurred the interest in SDP as a modeling tool in various mathematical fields. In the context of combinatorial optimization, it turned out that SDP is particularly effective, if the underlying 0-1 formulation of the problem involves quadratic terms. In this talk, several SDP relaxations of NP-hard combinatorial optimization problems will be discussed. We also address relaxations based on the cone of completely positive matrices as a more recent tool.

These relaxations can be used either theoretically, to get approximations with an a priori upper bound on the error. They can also be used computationally to solve the underlying problem to optimality. Some recent developments in both directions will be presented. These cover Max-Clique, Graph Coloring and other Graph partition problems. The resulting SDP are typically of sizes, not accessible by interior point methods. We therefore also discuss some very recent algorithmic developments to solve these relaxations.

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Firms spend considerable resources in devising product costing systems. These systems divide up a firm’s capacity costs (e.g., the cost of machinery and buildings) into pieces attributable to individual products and customers. Overwhelming evidence shows that managers worldwide use allocated costs for making product pricing and capacity planning decisions. For example, firms routinely drop product lines that do not recover their full (allocated) cost. Economists question this practice. They argue that the costs being allocated comprise of a firm’s committed/sunk costs. Thus, these costs or their allocations are irrelevant from a decision making perspective. I aim to summarize recent research that seeks to reconcile theory with practice, and offer avenues for additional work.

The core idea of this research stream is the notion that a firm’s product- and capacity-planning problem is computationally complex. A conceptually correct formulation is multi-period stochastic optimization problem with complex linkages across periods (e.g., inventory) and constraints (e.g., multiple resources used by the same product). Accounting researchers argue that this problem is not solvable. They argue that product cost data can serve as economically sufficient statistics that permit problem decomposition. Such decomposition would permit managers to deal with pricing problems that pertain to individual products and planning problems that deal with each capacity resource. This research, which has many links to operations research, has examined questions under which such problem decomposition is costless and problem features that lead to a loss. Even when product cost is not economically optimal, it is reasonable to think of it as a heuristic that aids 'local' decision making. This view raises the question of the magnitude of the economic loss from using heuristics, as well as methods for improving our estimation. In particular, it is of interest to examine the sources of error (e.g., model specification, aggregation and/or measurement) and their implications for the accuracy of product costs. Simulations play a significant role in this research stream that has considerable practical appeal. Finally, current research has begun to examine questions of how the robustness of problem solutions to the error in the estimates.

2 - Electre methods: main features and new developments

Bernard Roy, LAMSADE, Université Paris-Dauphine, Paris Cedex 16, France, roy@lamsade.dauphine.fr, José Rui Figueira

After a brief description of the constructivist conception in which ELECTRE method is inserted, we shall present the main features of theses methods. They include elements such as, the possibility of modeling by taking into account positive and negative reasons, without any recoding of data; thresholds used to take into account the imperfect knowledge of data; absence of systematic compensation between ‘gains’ and ‘losses’. The main weaknesses will also be presented. Then, some aspects related to new developments will be presented. They are related to new methodological tools, new procedures, axiomatic, and many other aspects. Finally, some concluding remarks will be outlined.

Tuesday 11:20-12:40

TC-01

TC-01 Tuesday 11:20-12:40

Beethoven

Some recent advances in 0-1 integer programming

Stream: Combinatorial Optimization

Invited session

Chair: Monique Guignard-Spielberg, OPIM, University of Pennsylvania, 5th floor, JMHH, 3730 Walnut Street, 191046340, Philadelphia, PA, United States, guignard_monique@yahoo.fr

1 - New reformulation and hybrid method for the bi-objective max—min knapsack problem

Raid Mansi, LAMIIH- SIAD, Université de Valenciennes-ISTV2, Le Mont-Houy, 59313, Valenciennes, France, raid.mansi@univ-valenciennes.fr, Saïd Hanafi, Christophe Wilbaut

The bi-objective max-min knapsack problem (BKP) is a variant of the classical zero-one knapsack problem, where the values of items differ under two possible scenarios. In this paper, we first show the equivalence between solving the BKP and solving two knapsack problems with an additional constraint, and we provide upper and lower bounds. Next, we present a hybrid method mixing heuristics and mathematical programming to solve efficiently the BKP. The method is compared with existing works and the results show the robustness of the approach, even for difficult instances.

2 - Recent experimental results on the rlt3 lower bound for the quadratic assignment problem

Peter Hahn, Electrical and Systems Engineering, University of Pennsylvania, 200 South 33rd Street, 19104-6314, Philadelphia, PA, United States, hahn@seas.upenn.edu, William Hightower, Monique Guignard-Spielberg, Matthew Saltzman

We present a QAP lower bound algorithm, based on a level-3 formulation linearization technique (RLT3). Our algorithm closely approximates RLT3 bounds and reaches them in some instances. It solves Nugent instances up to N=24 exactly or verifies the optimum. Problems of size N>25 present a challenge, due to memory needs for the RLT3 formulation. We describe steps to significantly conserve memory via the RLT3 formulation symmetries. We report use of this algorithm in a branch-and-bound solver. Our experiments determine the direction for needed research on this promising solution method.

3 - A chr heuristic for solving the gqap problem and extensions

Monique Guignard-Spielberg, OPIM, University of Pennsylvania, 5th floor, JMHH, 3730 Walnut Street, 191046340, Philadelphia, PA, United States, guignard_monique@yahoo.fr, Aykut Ahtaticoglulu

The CHR (Convex Hull Relaxation) approach can be used as a heuristic for nonconvex quadratic 0-1 programming problems (for convex problems, it also provides a valid bound). By starting the algorithm from different 0-1 points, one can force the inner simplicial decomposition algorithm to produce different paths and end at possibly different feasible 0-1 solutions. Each run is so quick that one can afford to use multiple starts. We will present results on GQAP problems from the literature, and on some practical problems that have recently been shown to be special cases of the GQAP.
Metaheuristics for Transportation Planning I

Stream: Transportation Planning

Invited session

Chair: Karl Doerner, Department of Business Studies, University of Vienna, Brünner Strasse 72, 1210, Vienna, Austria, karl.doerner@univie.ac.at

1 - Heuristics for the multi-period orienteering problem with multiple time windows

Fabien Tricoire, Department of Business Administration, University of Vienna, Chair for Production and Operations Management, Brünner Straße 72, 1210, Vienna, fabien.tricoire@univie.ac.at, Martin Romauch, Karl Doerner, Richard Hartl

We present the Multi-Period Orienteering Problem with Multiple Time Windows, a new routing problem combining objective and constraints of the Team Orienteering Problem (TOP) and original constraints from a real-world application. Specific route duration constraints result in a route feasibility subproblem. We propose an exact algorithm for this subproblem, and we embed it in a Variable Neighborhood Search method to solve the whole routing problem. We also adapt our method to standard benchmark TOP instances, and provide comparative tables with state-of-the-art algorithms.

2 - Solving a multi-objective covering tour model with stochastic demands for disaster relief

Walter Gutjahr, Department of Statistics and Decision Support Systems, University of Vienna, Universitätsstraße 3/3, 1010, Vienna, Austria, walter.gutjahr@univie.ac.at

In a humanitarian logistics application, a population has to be supplied by goods delivered by vehicles. The vehicles stop at distribution centers (DCs) which are to be selected in advance. The second is expected uncovered demand. Mathematical programming techniques and metaheuristics are used to compute Pareto-optimal solutions.

3 - Vehicle routing and the value of postponement

Luc Muyldermans, Business School, Nottingham University, Jubilee Campus, Wollaton Road, NG8 1BB, Nottingham, luc.muyldermans@nottingham.ac.uk, Gu Pang

We study Capacitated Vehicle Routing Problems in which the client demands occur over time and the collector or distributor performing the service can decide when to visit the clients. It has been reported in the literature that postponement of collection or delivery services may decrease the overall routing cost. We investigate this issue in greater detail and report on experiments in different routing settings to uncover the impact of postponement on routing efficiency. We compare the results by a local search procedure with those obtained from an analytical Continuous Approximation model.

Network optimization

Stream: Network Optimization

Invited session

Chair: Frits Spieksma, of Operations Research and Business Statistics, Katholieke Universiteit Leuven, Naamsestraat 69, B-3000, Leuven, Belgium, frits.spieksma@econ.kuleuven.be

1 - Combining profit maximization and risk management for creating end-to-end bandwidth guaranteed services

Aparna Gupta, Lally School of Mgmt, Rensselaer Polytechnic Institute, Troy, NY, United States, guptaa@rpi.edu

A spot-pricing framework for end-to-end (e2e) bandwidth guaranteed services using path-vector approach is employed, where an ISP combines its intra-domain contract links with service contracts from neighboring ISPs to construct e2e contract paths. We first obtain a nonlinear pricing model under static network condition, that maximizes the ISP’s profits, followed by extending the model for stochastically varying user demands and network conditions. Detailed risk assessment and management strategies are studied to cope with the inherent risks under different network setups and market conditions.

2 - The impact of different transportation cost measurements on hybrid hub and spoke network design

Anne Paul, Department of Business Policy and Logistics, University of Cologne, Albertus-Magnus-Platz, 50923, Köln, Germany, anne.paul@wiso.uni-koeln.de

Hybrid hub and spoke networks have proven to be both a cost-efficient and service-oriented structure for less than truckload operations. Transportation costs on the different arcs of the network are an important influence factor for network design. However, they can be measured variously, especially regarding their practical applicability for a logistics service provider. Thus, we analyze and discuss different cost measurements as to their impact on network design. Our findings are of importance for strategic managerial decisions as we illustrate based on a large scale transportation network.

3 - Charlemagne’s challenge: the periodic latency problem

Frits Spieksma, of Operations Research and Business Statistics, Katholieke Universiteit Leuven, Naamsestraat 69, B-3000, Leuven, Belgium, frits.spieksma@econ.kuleuven.be, Sofie Coene, Gerhard J. Woeginger

Given is a single server traveling at unit speed, and a set of clients with a known distance for each pair of clients. For each client, a periodicity is known, that is the maximum amount of time that is allowed to pass between two consecutive visits of the server. The goal is to find a repeatable route for the server serving as many clients as possible without violating the periodicities of the served clients. We derive hardness results for different version of this problem, and we give algorithms for different topologies.
1 - A genetic algorithm for inventory constrained scheduling on a single machine

Dirk Briskorn, Department for Production and Logistics, University of Kiel, Olshausenstrasse 40, 24098, Kiel, Germany, briskorn@bwl.uni-kiel.de

We consider inventory constraints in a single machine environment. Here, jobs add and remove items to an inventory and from an inventory, respectively. Jobs removing items cannot be processed if the required amount of items is not available. We consider problems on a single machine with the objective functions common in machine scheduling and develop a GA framework to solve them. We outline concept of the algorithm as well as computational results.

2 - A genetic algorithm to minimise the maximum lateness on a single machine family scheduling problem

Lai-Soon Lee, Laboratory of Applied and Computational Statistics, Universiti Putra Malaysia, Institute for Mathematical Research, Universiti Putra Malaysia, 43400, UPM Serdang, Selangor, Malaysia, lee@math.upm.edu.my, Hafiezah Nazif

We consider a Single Machine Family Scheduling Problem where jobs are partitioned into families and setup time is required between families. For this problem, we propose a genetic algorithm using an optimised crossover operator designed by an undirected bipartite graph to find an optimal schedule that minimises the maximum lateness of the jobs in the presence of the sequence independent family setup times. Comprehensive results are presented and the proposed approach is shown to be competitive when compared with other competing local search algorithms.

3 - A genetic algorithm approach for the single machine earliness/tardiness scheduling problem with job-independent penalties

Jorge Valente, Faculdade de Economia - LIAAD - INESC Porto L.A., Universidade do Porto, Rua Dr. Roberto Frias, 4200-464, Porto, Portugal, javalente@fep.up.pt, Saurabh Bharti, Kunal Prasad

We consider the single machine early/tardy scheduling problem with job-independent penalties, and no machine idle time. Several genetic algorithms are proposed, and compared with the best existing heuristic procedure. The computational results show that the performance of the genetic versions is improved by the addition of a local search procedure, the initialization of the first population and the use of an elitist mutation strategy. The genetic versions, particularly those that incorporate the local search procedure, clearly outperform the best existing heuristic.

4 - Cooperative and multicore genetic algorithms for the permutation flowshop problem

Eva Vallada, Estadística e Investigación Operativa Aplicadas y Calidad, Universidad Politécnica de Valencia, Cno. Vera s/n Edificio I-3, 46022, Valencia, Spain, evallada@eio.upv.es, Gema Escrivá

In this work a genetic algorithm for the permutation flowshop problem with the objective to minimize the total tardiness is proposed. The genetic algorithm is based on the island model and uses the most recent technologies, where more than one core is available in the processor of the computer. Each core runs the algorithm in parallel and communications through messages are allowed. A comparative evaluation against the serial counterparts and some of the best methods available in the literature is carried out. Results show that the cooperative multicore algorithm outperforms all other methods.
4 - Gene prioritization in platelets
Francisco Bonachela Capdevila, KU Leuven, campus Kortrijk, B-8500, Kortrijk, Belgium, Francisco.BonachelaCapdevila@kuleuven-kortrijk.be, Patrick De Causmaecker, Hans Deckmyn

Blood platelets can form a thrombus leading to e.g. myocardial infarction or stroke. Effective and safe platelet inhibitors are needed. Proteomics and genomics have identified thousands of proteins expressed by blood platelets, a number that exceeds the analytical capacity. Thus a gene ranking is needed. To perform such a ranking we used Endavour with a new database called Haemlatas which is a gene expression atlas for blood cells. We also applied a clustering preprocessing step, previous to the prioritization, to obtain a more homogeneous training set using the clustering algorithm CLOPE.

TC-06
Tuesday 11:20-12:40
Koch

Real life applications of MCDM/MDCA
Stream: OR and Real Implementations
Invited session
Chair: Pekka Salminen, School of Business and Economics, University of Jyväskylä, P.O.Box 35, FI-40014, Jyväskylä, Finland, Pekka.Salminen@econ.jyu.fi

1 - Multi-criteria benefit-risk analysis of viagra, levitra, and cialis
Tommi Tervonen, Faculty of Economics and Business, University of Groningen, PO Box 800, 9700AV, Groningen, t.p.tervonen@rug.nl, Douwe Postmus, Hans Hillege

Regulatory agencies require drugs entering the market to have sufficient benefit-risk ratio in comparison to other drugs within the same therapeutic group. To provide more transparent and traceable decision making in line with principles of public European institutions, a more structured decision making process will be an advantage. In this presentation, we show how MCDCA can be applied to drug benefit-risk analysis in a way that takes into account different domains of clinical data. We analyze the therapeutic group of erectile dysfunction drugs consisting of Viagra, Levitra, and Cialis.

2 - MCDM tools in metsähallitus
Veikko Hiltunen, Forestry, Kainuu, Metsähallitus, Viestitie 2, 87700, Kajaani, Finland, Veikko.Hiltunen@metsa.fi

In multiple use management of state-owned lands, forests and waters in Finland a participatory planning process on regional level is applied. Plans are compiled for a ten year period by assessing production possibilities of the region and generating optional management strategies. Strategies are evaluated with help of MCDM tools. AHP, SMART and voting methods have been applied during the last 15 years. They have improved transparency of the processes, as well as acceptance of the results.

3 - A multi-criteria evaluation of household energy efficiency in South Africa
Ian Durbach, Department of Statistical Sciences, University of Cape Town, Room 3.04 PD Hahn North building, University of Cape Town Rondebosch, 7701, Cape Town, Western Cape, ian.durbach@uct.ac.za, Stephen Davis

Using a combination of systems dynamics and multi-criteria analysis, we build a simulation model of household energy consumption for a community in a small town in South Africa where an energy efficiency intervention took place. Longitudinal data collected from the community provides an empirical basis for the model as well as guiding numerical inputs to the simulation. The model is used as a basis for evaluating different energy-saving strategies and awareness campaigns.

4 - Decision support for centralizing cargo at a Moroccan airport hub using stochastic multicriteria acceptability analysis
Risto Lahdelma, Department of Energy Technology, Helsinki University of Technology, PL 4100, 02150, Espoo, Finland, risto.lahdelma@hut.fi, Abdelhaj Menou, Abdelhanine Benallou, Pekka Salminen

We evaluate different alternatives to centralize multimodal cargo at a Moroccan airport hub. Some of the evaluation criteria are measured cardinal, while for others only ordinal assessment is feasible. Significant uncertainty is present in both the criteria measurements and the preferences. We apply Stochastic Multicriteria Acceptability Analysis (SMAA). SMAA allows the representation of a mixture of uncertain, imprecise and partially missing information in a consistent way. The results describe the conditions that make each alternative the most preferred one, or give it a particular rank.

TC-07
Tuesday 11:20-12:40
GSI - S 29

Network and Route Design
Stream: Optimization in Public Transport
Invited session
Chair: Hilmi Berk Celikoglu, Department of Civil Engineering, Technical University of Istanbul, Faculty of Civil Eng., Division of Transportation, Ayazaga Campus, Maslak, 34469, Istanbul, Turkey, celikoglu@itu.edu.tr

1 - Improving the efficiency of swedish paratransit: an application of the dial-a-ride problem
Carl Henrik Hall, Dept of Science and Technology, Linköping University, Linköping University, Dept of Science and Technology (ITN), 60174, Norrköping, carha@itn.liu.se, Jan T. Lundgren, Anders Peterson

We study a Swedish application of the dynamic dial-a-ride problem where a major part of the requests is known in advance. Based on these requests we use a tabu search heuristic to find an efficient preliminary schedule. An insertion heuristic is then used for the remaining requests and local search procedures can improve the solution successively. These procedures are based on extraction and reinsertion of different subsets of all planned requests. Tests are made using data from the municipality of Norrköping in Sweden, having some 600 requests to be served each day.

2 - A stochastic reduction approach for public transport network design using ant colony optimisation and genetic algorithm
Bernhard Alt, Institute for Transport Planning and Systems (IVT), ETH Zurich, Wolfgang-Pauli-Str. 15, 8093, Zurich, Switzerland, alt@ivt.ee.ethz.ch
For public transport network design a new approach is proposed being able to use a more realistic transport model without increasing computing times too much. Its core is a reduction process, which requires comparatively few network evaluations. The reduction process starts with a shortest routes network. Lines are deleted, merged or shortened sequentially using ant colony optimization. A genetic algorithm optimizes frequencies and vehicle sizes. For evaluation, mainly time costs and operating costs are considered. The used assignment is a headway based stochastic multiple route assignment.

3 - Equilibrium traffic assignment models calibration and o-d matrix estimation by aggregate data

Michele Ottomaneli, DIASS, Technical University of Bari, Via De Gasperi, 74100, Taranto, m.ottomaneli@poliba.it, Leonardo Caggiani, Domenico Sassanelli

A Generalized Least Square (GLS) estimator is presented to solve the simultaneous assignment model calibration and O-D matrix estimation based on aggregate data. The calibration problem is specified as an optimization problem using a fixed point formulation assuming the congested network case (equilibrium programming).

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Integrated vehicle scheduling

Stream: Optimization in Public Transport

Invited session

Chair: Leo Kroon, Rotterdam School of Management, Erasmus University Rotterdam, P.O. Box 1738, 3000 DR, Rotterdam, Netherlands, lkroon@rsm.nl

1 - Integrating timetabling and vehicle scheduling

Neele Hansen, ITWM Fraunhofer, Fraunhofer Platz 1, 67663, Kaiserslautern, Germany, neele.hansen@gmail.com, Sven Krumke

We consider the task to construct an optimal vehicle schedule in a variable timetable. We are given tours to be covered by vehicles and for each tour a finite set of possible shifts. Depending on the selection of shifts, it may be possible to combine tours. However, choosing shifts influences the transit times of customers at the changeover station which is reflected in the model by a penalty value. The goal is to minimize the sum of the penalty values and the cost of serving all tours. We provide hardness results for various cases and computational results on real-world data.

2 - Modeling a simultaneously line network and schedule optimization in public transport

Michael Rittner, Chair for Traffic Flow Science, TU-Dresden, Faculty of Transport and Traffic Science, Hettnerstr. 1, 01069, Dresden, Saxony, michael.rittner@tu-dresden.de, Karl Nachtigall

To create a competitive offer in public transport, it is necessary to use the limited financial resources of the transport companies in an optimal way to ensure a high quality transport for the passenger. In this paper a mixed model for simultaneous line network and schedule optimization in public passenger transport is presented, which is modeled as a mixed integer linear problem. One of the major challenges is to maintain a linear model by adding the precise operating costs, the interchange waiting times, and the special schedule restrictions.

3 - A framework for a flexible vehicle scheduling system

Jozsef Bekesi, University of Szeged, H-6725, Szeged, Hungary, bekesi@igykp.u-szeged.hu, Miklos Kresz, David Pash, Andrej Brodnik

A flexible framework for vehicle scheduling is presented which was developed for public bus transportation systems. The framework builds upon the theoretical foundation that has been established in this area and extends it to incorporate additional real-world constraints. We have applied our approach to the urban bus system of two middle-sized cities, and computed substantially better schedules than the previous ones prepared by-hand. Finally, we present some preliminary results in improving the computational time through the use of a parallel computing environment.

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Production Systems

Stream: Supply Chain Management

Invited session

Chair: Yamani Massim, ICD (CNRS FRE 2848) LOSI, Universite de Technologie de Troyes, 10000, Troyes, France, yamanimassim@yahoo.fr

1 - The integration of kanban principles in campaign production systems

Jürgen Strohhecker, Management Research Centre, Frankfurt School of Finance & Management, Sonnemannstraße 9-11, 60314, Frankfurt am Main, Germany, Germany, j.strohhecker@frankfurt-school.de, Rainer Sibbel, Marcel Dick

Centralized planned campaign production is the predominant production system in the process industry. In this paper we investigate, if a decentralized KANBAN system, which has given proof of its advantages in other industries, can be integrated in a campaign production environment. For this purposes we use a research methodology, which combines model- and case-study-based elements. We find that a KANBAN campaign production system can be favourable; however, using a pilot scheme cannot be recommended, when the campaign sizes for other products seizing the same equipment are too high.

2 - An integrated simulation based nonlinear integer programming approach for minimization of surplus inventory in selective assembly

Erdal Emeıl, Industrial Engineering Department, Uludag University, Faculty of Engineering and Architecture, Gorukle Campus, 16059, Bursa, Turkey, erdal@uludag.edu.tr, Mehmet Akansel, Volkan Hacioglu

A simulation optimization model is developed to minimize the surplus inventory of two matching parts. A nonlinear integer mathematical model is used to obtain process means of parallel workstations feeding selective assembly. Only process mean of part with smaller variance can be shifted. Using calculated means in a simulation model, average inventory levels are obtained at the end of a given production time. Optimal production time before shifting means is then calculated by EOQ model with average costs obtained from simulation with varying production times using response surface methods.
3 - A fuzzy programming approach for an integrated production and distribution planning problem with uncertain conditions

Bilge Bilgen, Industrial Engineering, Dokuz Eylul University, Tinaztepe Campus, Buca, 35160, Izmir, Turkey, bilge.bilgen@deu.edu.tr

This paper applies fuzzy sets to the production and distribution planning problem in a supply chain system that involves the allocation of production volumes among the different production lines in the manufacturing plants and the delivery of the products to the distribution centers. The proposed fuzzy attempts to minimize the total supply chain cost considering production, vehicle capacity, setup and demand restrictions. An industrial case is presented to demonstrate the feasibility and applicability of the model.

4 - Efficient combined immune-decomposition algorithm for optimal buffer allocation in production lines for throughput and profit maximization

Yamani Massim, ICD (CNRS FRE 2848) LOSIL, Universite de Technologie de Troyes, 10000, Troyes, France, yamani.massim@etu.fr, Farouk Yalaoui, Lionel Amodeo, Eric Chatete, Abdelkader Zeblah

The optimal allocation of buffers in transfer lines is crucial to the optimization of line throughput and work in process inventory (WIP) and is subject to specific constraints, associated costs, and revenue projections. In this paper, we implement an efficient combined artificial immune system optimization algorithm in conjunction with a decomposition method to optimally allocate buffers in transfer lines with unreliable machines. Results of extensive series of tests carried out to compare the performance of the proposed method and those of other algorithms are presented.

TC 10
Tuesday 11:20-12:40
GSi - S 6

Educational Timetabling

Stream: Timetabling and Rostering

Invited session

Chair: Wolfgang Brüggemann, Inst. f. Unternehmensforschung, Universität Hamburg, Von-Mell-Park 5, 20146, Hamburg, Germany, brueggemann@uni-hamburg.de

1 - Scheduling college classes at two universities using operations research techniques

Terri Friel, Walter E Heller College of Business Administration, Roosevelt University, 430 S. Michigan Avenue, 60605, Chicago, IL, tfriel@roosevelt.edu, Barry King

This paper outlines successful efforts taken at Butler University to construct semester class schedules using a mixed integer linear programming problem to develop a schedule of classes and an assignment procedure to allocate faculty to the schedule. The work at Butler University was performed in SAS using SAS’S OPTMILP mixed integer linear program solver and the MPS modeling language and SAS’S ASSIGN solver for the assignment phase. The paper also discusses an improved version at Roosevelt University for scheduling SAS’S ASSIGN solver for the assignment phase. The paper also discusses an improved version at Roosevelt University for scheduling.

2 - A multiobjective mathematical model for exam-timeslot-room assignment problem

Muğan Sagir, Industrial Engineering Dept., Eskisehir Osmangazi University, Bademlik, 26030, Eskisehir, Turkey, mugan.sagir@gmail.com, Zehra Kamisli Ozturk

Assigning exams to time slots is a time consuming problem educational institutions face a few times in each term. Room assignments are either considered within the exam scheduling or can be solved separately. Here, a multi objective mathematical model, with room splitting, is developed for exam-timeslot-room assignments. A real case application is provided. The outcome is compared with the current schedule. The proposed approach gives better solutions will increase overall performance of the educational systems from the point of students view as well as efficient use of resources.

3 - Optimal preference-based assignment of university students to parallel offered teaching groups

Wolfgang Brüggemann, Inst. f. Unternehmensforschung, Universität Hamburg, Von-Mell-Park 5, 20146, Hamburg, Germany, brueggemann@uni-hamburg.de, Henrik Heitmann

In a university-course timetabling problem, there may be many parallel sections of the same class or tutorial which do not necessarily need to be scheduled simultaneously. Then each student must subsequently be assigned to one of these. Students’ preferences can be used as the objective of the resulting mixed-integer optimization problem with the additional constraints that time clashes have to be avoided on an individual basis. The structure of possible preferences is explored by survey data and first results for artificial test instances of this problem are discussed.

TC 11
Tuesday 11:20-12:40
GSi - S 17

Algorithmic Decision Theory I

Stream: Multiple Criteria Decision Analysis

Invited session

Chair: Alexis Tsoukiàs, CNRS - LAMSADE, Université Paris Dauphine, 75775, Paris Cedex 16, France, tsoukias@lamsade.dauphine.fr

1 - Additive conjoint measurement with ordered categories

Denis Bouyssou, CNRS-LAMSADE, France, bouyssou@lamsade.dauphine.fr, Thierry Marchant

Conjoint measurement studies binary relations defined on product sets. The central model is the additive value functions model. Building a recommendation on the basis of a preference relation between alternatives is not always adequate since the model is relative. This calls for methods having a more absolute character. They lead to build a partition of the set of alternatives into ordered categories. This paper studies additive representations. Our main result will give sufficient conditions for the existence of an additive representation of a threefold ordered partition.

2 - What is a decision problem?

Alexis Tsoukiàs, CNRS - LAMSADE, Université Paris Dauphine, 75775, Paris Cedex 16, France, tsoukias@lamsade.dauphine.fr, Alberto Colorni

In this paper we propose a general framework enabling to define as decision problem a variety of situations both in a human or in an artificial setting. We define the concept of “problem statement” and then specify a number of characteristics which characterise different decision problems and the methodology to handle them. The framework allows to define both traditional Operational Research problems as well as problems arising in Computer Science and Artificial Intelligence.
3 - Reaching a decision is great, but it’s even better if it is justified
Wassila Ouerdane, LAMSADE- Université Paris Dauphine, Place du Marechal de Lattre de Tassigny, 75016, PARIS, wassila.ouerdane@lamsade.dauphine.fr

We propose, in this work, to specify in argumentative terms the steps involved in an evaluation stage of a decision aiding process, a sort of dialogue between a decision maker and an analyst. To do that, we make use of the popular notion of argument schemes, and specify the related critical questions. A hierarchical structure of the schemes allows to decompose the process into several distinct steps and for each of them the underlying premises are made explicit, which allows in turn to identify how these steps can be dialectically defeated via critical questions.

4 - Questioning about weights and the strength of coalitions of criteria
Marc Pirlot, Mathematics and Operational Research, Faculté Polytechnique de Mons, Rue de Houdain 9, B-7000, Mons, Belgium, marc.pirlot@fpms.ac.be, Ersek Eda, Philippe Fortemps

We consider the problem of determining which coalitions are sufficiently strong in a multiple criteria aggregation procedure of the ELECTRE type (especially in the non-compensatory sorting model of Bouyssou and Marchant). Since we do not assume that the strength of a coalition can be represented by additive weights, the problem amounts to determine an antichain in the set of all subsets of criteria, namely, the antichain of minimally sufficient coalitions. We propose an algorithm for guiding a questioning process dynamically and another for finding an optimal questioning strategy.

2 - Time consistency for multiperiod risk measures: a reasonable concept?
Raimund Kovacevic, Statistics and Decision Support Systems, University Vienna, Universitätstr. 5, 1010, Wien, Wien, raimund.kovacevic@univie.ac.at

Time consistency of dynamic and multiperiod risk or acceptability functionals is a frequently discussed subject in financial risk analysis. We summarize related notions in a simple framework and analyze their basic properties. Special care is taken of partially conflicting concepts like information monotonicity and of applicability within the framework of multistage stochastic programming.

3 - Dynamic portfolio optimization with bounded shortfall risks
Ralf Wunderlich, Group of Mathematics, University of Applied Sciences, PSF 201037, 08056, Zwickau, Germany, ralf.wunderlich@fh-zwickau.de, Jörn Sass

We consider the optimal selection of portfolios for utility maximizing investors under joint budget and shortfall risk constraints. The shortfall risk is measured in terms of the expected loss. Stock returns satisfy a stochastic differential equation with an unobservable drift process leading to a market model with partial information. Under general conditions on the corresponding drift process we provide the optimal trading strategy using martingale method and Malliavin calculus. For a hidden Markov model (HMM) for the drift we present numerical results.

TC-12
Tuesday 11:20-12:40
GSI - S 18
Risk and Dynamics
Stream: Stochastic Programming
Invited session
Chair: Silvia Vogel, Mathematics and Natural Sciences, Ilmenau University of Technology, Postfach 100565, 98684, Ilmenau, Thurmingia, Germany, Silvia.Vogel@tu-ilmenau.de
Chair: Ralf Wunderlich, Group of Mathematics, University of Applied Sciences, PSF 201037, 08056, Zwickau, Germany, ralf.wunderlich@fh-zwickau.de

1 - Multiperiod optimization with stochastic dominance criterion
Milos Kopa, Department of Probability and Mathematical Statistics, Charles University in Prague, Faculty of Mathematics and Physics, Sokolovská 83, CZ 186 75, Prague, Czech Republic, kopa@karlin.mff.cuni.cz

This paper deals with multi-period portfolio selection model under stochastic dominance (SD) criteria. Following the SD efficiency ideas in one-period portfolio selection problem, the efficient investment strategy is defined. Second-order stochastic dominance (SSD) rule is considered as a criterion of efficiency. The algorithm for testing SSD efficiency of a given multi-period strategy is derived. Theoretical results are illustrated on a financial empirical example.

2 - Gis-based spatial interaction allocation using stochastic optimization
Eric Delmelle, Geography and Earth Sciences, University of North Carolina at Charlotte, 9201 University BLVD, UNCC, 28223, Charlotte, NC, Eric.Delmelle@uncc.edu
Optimally locating transportation infrastructure is deemed vital to successful planning, as they represent a potential to alleviate congestion. GIS facilitates location modeling by concurrently integrating geographic information and optimization solvers. A spatial interaction-based location allocation model is proposed, which—unlike the MCLP or P-median—simultaneously considers distance decay, coverage range and partial regional service. A stochastic optimization is suggested to solve this non-linear model. A case study illustrates the approach using GIS and bus stop locations.

3 - A GIS-based decision support system for competitive facility location

Burcin Bozkaya, Faculty of Management, Sabanci University, Orhanli, Tuzla, 34956, Istanbul, Turkey, bbozkaya@sabanciuniv.edu, Sedat Yanik

Competitive facility location problems involve decisions regarding location of new facilities (e.g., stores, bank branches) in the presence of competitors. Potential customers patronize facilities in relation to the attractiveness of each facility, in accordance with an extended version of Huff model. We present a novel DSS we have developed based on these premises. Users can specify problem parameters, review location decisions generated via optimization, create solutions manually and compare them with the proposed solution. We illustrate the system on a real dataset from the City of Istanbul.

4 - A multi-criteria GIS based procedure to solve a network competitive location problem

Rafael Suarez-Vega, Metodos Cuantitativos en Economia y Gestion, Universidad de Las Palmas de Gran Canaria, Edificio Departamental de Ciencias Economicas y Empresariales, Campus Universitario de Tafira, 35017, Las Palmas de Gran Canaria, Las Palmas, Spain, rsuarez@dmc.ulpgc.es, Dolores R. Santos-Peitane, Pablo Dotta-González

In this paper a competitive network location problem is treated. We consider a proportional choice rule derived from the Huff model, where facility location and other attributes, such as size and service quality, are considered. This problem is solved using Geographical Information Systems. Later, the obtained layer with the Huff facility location and other attributes, such as size and service quality, is considered. This problem is solved using Geographical Information Systems. Later, the obtained layer with the Huff capture is considered as a criterion to determine the most promising zones on the island of Gran Canaria to localize a new hypermarket using a multi-criteria GIS based model.

TC-14

Tuesday 11:20-12:40

GSI - S 32

Supply Chain Inventories

Stream: Inventory Management

Invited session

Chair: Jörn Grahl, Information Systems & Business Administration, University of Mainz, Jakob Welder-Weg 9, 55099, Mainz, grahl@uni-mainz.de

1 - Inventory planning in standard business software

Thomas I. Maindl, University of Cologne, Cologne, Germany, maindl@yahoo.com, Sascha Herpers

This paper gives an overview of the inventory planning capabilities of standard business software, namely the SAP Business Suite and is intended to bridge the domains of supply chain management theory and the business software industry including Enterprise Resource Planning and Advanced Planning Systems.

2 - An integrated approach to safety stock optimization in serial supply networks

Daniel Dittmar, Schumpeter School of Business, University of Wuppertal, WINFOR - Business Computing and Operations Research, Gaulstr. 20, 42097, Wuppertal, ddittmar@winfor.de, Steffen Klosterhalfen, Stefan Minner

Safety stock is a widely used means to cope with demand uncertainty in supply chains. In the literature, basically two competing approaches are available for optimizing safety stocks in multi-echelon networks, the Guaranteed Service Approach (GSA) and the Stochastic Service Approach (SSA). We introduce a combination of both approaches, the so-called Hybrid Service Approach (HSA), which exploits their respective advantages. For serial supply chains, we present the HSA optimization model and show how it can be solved to optimality by a dual-state dynamic programming algorithm.

3 - Multiple sourcing in multi-echelon inventory systems

Steffen Klosterhalfen, Department of Logistics, University of Mannheim, Schloss S 233, Mannheim, 68131, Mannheim, Baden-Württemberg, Germany, klosterhalfen@bwl.uni-mannheim.de, Stefan Minner, Sean Willems

Multiple sourcing is very common in practice, but there are only few scientific contributions considering multiple suppliers or transportation modes in large multi-echelon systems. We show how to include multiple sourcing in the guaranteed-service framework. With respect to the inventory control policy, we assume that each stage splits its orders across multiple sources according to certain supply fractions. For serial systems, we show that the optimal policy still satisfies the all-or-nothing property. This property is exploited in the development of a solution algorithm.

4 - Lower bounds for the cost of strategic safety stocks in multiple echelons

Jörn Grahl, Information Systems & Business Administration, University of Mainz, Jakob Welder-Weg 9, 55099, Mainz, grahl@uni-mainz.de

We consider multi-stage safety stock optimization in the guaranteed-service framework. Two techniques are presented for bounding minimal cost from below. The first lower bound constructs a surrogate problem instance whose optimum is known and cheaper than that of the original problem instance. The second lower bound is based on marginal costs arising from service time allocations. Both bounds are evaluated in experiments. First steps towards approximation algorithms are presented also.

TC-15

Tuesday 11:20-12:40

Einstein

Exact Approaches for Routing Problems

Stream: Vehicle Routing

Invited session

Chair: Andrea Tramontani, DEIS, University of Bologna, Viale Risorgimento 2, 40136, Bologna, Italy, andrea.tramontani@unibo.it

1 - An exact method for the vehicle routing problem with time windows

Roberto Roberti, DEIS, University of Bologna, Via Sacchi, 3, 47023, Cesena, Italy, roberto.roberti6@unibo.it, Roberto Baldacci, Aristide Mingozzi
We present an exact algorithm for the Vehicle Routing Problem with Time Windows based on the set partitioning formulation. A valid lower bound is computed combining different dual ascent procedures and a pricing and cut method. The final dual solution is used to generate a reduced problem containing the arcs that can belong to any optimal solution. The final problem is solved by a general purpose integer programming solver. Computational results show that the proposed method solves to optimality all but one Solomon instances and outperforms the best known methods.

2 - An integer programming approach for the time-dependent travelling salesman problem

Juan Jose Miranda Bront, Computer Science Department, University of Buenos Aires, Av. Cantilo s/n, Pabellon I, Cdad. Universitaria, C1428EGA, Ciudad Autonoma de Buenos Aires, jmiranda@dcuba.ar. Isabel Mendez-Diaz, Paula Zabala

The Time-Dependent Travelling Salesman Problem (TD-TSP) is a generalization of the traditional TSP where the travel cost between two cities depends on the moment of the day the arc is taken. In this paper, we focus in the case where the travel time between two cities depends not only on the distance between them, but also on the position of the arc in the tour. We consider the formulation proposed in Picard and Queyranne (1978) and derive some valid inequalities. We also present computational results for a Branch and Cut algorithm that incorporates these inequalities.

3 - An extended formulation for the traveling salesman problem with time windows

Andrea Tramontani, DEIS, University of Bologna, Viale Risorgimento 2, 40136, Bologna, Italy, andrea.tramontani@unibo.it, Sanjeeb Dash, Oktay Gunluk, Andrea Lodi

We address the Traveling Salesman Problem with Time Windows (TSP-TW). We present an extended integer programming formulation for TSP-TW, based on a relaxed discretization of time windows. The proposed formulation yields strong lower bounds and leads to strong valid inequalities which can be effectively separated. The resulting branch-and-cut algorithm is tested on hard asymmetric benchmark instances from the literature. The results show that the proposed formulation is effective for tackling TSP-TW. Interestingly, several unsolved benchmark instances are here solved for the first time.

Up to now, research on speed-up techniques for Dijkstra’s algorithm focused on single-criteria scenarios. In this work, we study multi-criteria search in road networks. We present a multi-criteria variant of our SHARC algorithm. Unlike other speed-up techniques for Dijkstra’s algorithm, SHARC uses a unidirectional query making it the first choice for adapting a technique to a multi-criteria scenario. It turns out that multi-criteria SHARC yields speed-ups of a factor of up to 15000 over a generalized version of Dijkstra’s algorithm. This is even more than in a single-criteria setup.

2 - A solution approach for the multicriteria shortest path problem with soft constraints

Luigi Di Puglia Pugliese, Dipartimento di Elettronica, Informatica e Sistemistica, Università della Calabria, Via Bucci, 87030, Rende, ldpuglia@deis.unical.it, Francesca Guerriero, Janusz Granat

The multicriteria single-origin single-destination shortest path problem is considered. Moreover, each criterion value belongs to a specified range. The considered problem can be formulated as a constrained multicriteria shortest path problem. Generally, the optimal solution could not exist. Thus, the main aim is to find a solution for which each criterion is very close to the bound interval. The problem is formulated using the reference point methodology and a Branch & Bound algorithm is developed for its solution. The behaviour of the proposed algorithm is experimentally evaluated.

3 - Parameters to assess the computational effort involved in the multi-criteria shortest path problem

José Santos, Department of Mathematics, University of Coimbra, Department of Mathematics, FCTUC, Apartado 3008, 3001-454 Coimbra, 3001-454, Coimbra, Portugal, zeluis@mat.uc.pt, José Paixão

In the multi-criteria shortest path problem there is no, in general, a single solution that minimizes all criteria, addressing us to find the Pareto optimal solutions (POS) set. The computational effort to compute the POS between the initial and terminal nodes depends on the total number of POS to the remainder nodes. However, this fact does not explain alone all this effort especially when comparing results among different types of network. In this work we propose new parameters to assess the computational effort with a correlation coefficient greater than other parameters from the literature.

4 - The bicriterion stochastic knapsack problem

Kim Allan Andersen, CORAL, Department of Business Studies, Aarhus School of Business, Fuglesangs Alle 4, 8210, Aarhus V, Denmark, kia@asb.dk, Matthias Ehrgott, Lars Relund Nielsen, Daniele Pretolani

We have a known capacity of a resource, and a set of projects. Each project requires some units of the resource which is given by a discrete probability distribution. The resource requirements become known when a project has been selected. In that case two rewards are received, which only depend on the project chosen. The goal is to design a set of resource adaptive strategies for choosing the projects such that the total expected value of the two objective functions is maximized. We describe a two-phase method for solving the problem. Preliminary computational results are presented.
In this paper we present 0-1 integer linear programming models for the container loading problem, considering cargo stability and load bearing strength of the boxes. In order to validate the models, we generated a number of instances and solved them using commercial software. Although the models are limited to solve to optimality only problems of moderate size, these models can be useful for future research exploring decompositions, relaxations, heuristics and others.

Invited session
Chair: Reinaldo Morabito, Dept. of Production Engineering, Federal University of São Carlos, CP 676, 13565-905, São Carlos, Sao Paulo, Brazil, morabito@ufscar.br

1 - 3d bin packing problem with fuzzy information
Ugur Eliyiyi, Department of Statistics, Dokuz Eylul University, Tinaztepe Kampusu, Buca, 35160, Izmir, Turkey, ugur.eliyi@ogr.deu.edu.tr

We review alternative solution approaches for the 3D Bin Packing Problem in literature. The problem involves the packing of 3D objects in a minimum number of containers. Relevant industrial and scientific application areas are reviewed, as well as the main features of the optimization software applications for handling the problem. We redefine and model the problem in the presence of fuzzy information, which corresponds to fuzzy dimensions for the objects and/or the container. Heuristic algorithms for efficiently solving this hard problem and possible application areas are discussed.

2 - A mip approach for solving the stowage problem on board the international space station
Giorgio Fasano, Space Infrastructures & Transportation, Thales Alenia Space Italia, Str. Antica di Collegno 253, 10146, Turin, Italy, giorgio.fasano@thalesaleniaspace.com, Claudia Lavopa, Maria Chiara Vola, Davide Negri

A challenging issue related to the International Space Station concerns the stowage on-board, giving rise to strong impacts to productivity, habitability and safety. Very demanding packing problems must be solved efficiently, with high cost-effectiveness to optimize the stowage, increasing habitability and crew productivity. The volume exploitation has to be maximized with the given accommodation rules. A MIP-based heuristic tackles the issue by a sequence of sub-problems, formulated in terms of knapsack, bin packing and three-dimensional single bin packing with additional conditions.

3 - A fast heuristic for a three-dimensional non-convex domain loading problem
Antonio Sforza, Dipartimento di Informatica e Sistemistica, Università di Napoli, via Claudio 21, 80125, Naples, Italy, sforza@unina.it, Maurizio Boccia, Claudio Sterle

A three-dimensional non-convex domain loading problem is presented. We have to load homogenous boxes into a non-convex domain. The boxes have size dxdxmd, with n and m integer values. This problem has never been treated in literature, neither with exact nor with heuristic methods. We present a fast heuristic based on an approximate representation of the non-convex domain and on the decomposition of the whole problem in several two-dimensional sub-problems. It shows good performances in terms of quality of solution and computation times. The results on several real test cases are shown.

4 - Optimization models for container loading problems with cargo stability and other considerations
Reinaldo Morabito, Dept. of Production Engineering, Federal University of São Carlos, CP 676, 13565-905, São Carlos, Sao Paulo, Brazil, morabito@ufscar.br, Leonardo Junqueira, Denise Yamashita

We redefine and model the problem in the presence of fuzzy information, which corresponds to fuzzy dimensions for the objects and/or the container. Heuristic algorithms for efficiently solving this hard problem and possible application areas are discussed.
The electric power market is represented by a Stackelberg game with two firms. Initially, this optimization problem is formulated as a Mathematical Program with Complementarity Constraints (MPCC). Then, it is reformulated into a nonlinear optimization problem (NLP) in order to take advantage of NLP solvers robustness. Some NLP solvers based on Filter and Interior Point approaches are used to solve the problem. A performance comparative analysis is reported.

4 - Optimal control with nonlinear programming
Helena Sofia Rodrigues, Escola Superior de Ciências Empresariais, Instituto Politécnico de Viana do Castelo, Av. Miguel Dantas, 4930-678, Valença, Portugal, sofia.rodrigues@esce.ipvc.pt, M. Teresa Torres Monteiro, Delfim F. M. Torres

In general solving an optimal control problem is not easy. One way to address the question consists to look to an optimal control problem as an infinite-dimensional extension of a Nonlinear Programming (NLP) problem. In this work we investigate the use of NLP techniques to solve some classical and recent challenging problems of optimal control.

TC-19
Tuesday 11:20-12:40
Haber

Tabu search
Stream: Metaheuristics

Invited session
Chair: Nihan Karaca, Industrial Engineering, Istanbul Kultur University, Osman Yilmaz Mah.Millet Cad. Mimoza Apt. Gebze/Kocaeli/Turkey, 41400, Kocaeli, Turkey, karacanihan@gmail.com

1 - Fast tabu search implementations for atsps defined on complete graphs
Diptesh Ghosh, Production and Quantitative Methods, Indian Institute of Management, Ahmedabad, Vastrapur, Ahmedabad, Gujarat, India, diptesh@iimahd.ernet.in, Sumanta Basu

Using appropriate data structures, it is possible to implement tabu search (TS) to solve asymmetric traveling salesman problems (ATSPs) defined on sparse graphs much faster than conventional TS implementations. In this paper we use such data structures to speed up TS implementations to solve ATSPs defined on complete graphs. We first pre-process ATSPs defined on complete graphs to obtain ATSPs defined on sparse graphs. We then use TS to solve the pre-processed instances without significant deterioration in solution quality. We report our computational experience on benchmark ATSPs defined on complete graphs without significant deterioration in solution quality. We report our computational experience on benchmark ATSPs defined on complete graphs.

2 - Improving slicing layouts with bottom left positioning of departments
Daniel Scholz, FB 01 FG Operations Research, TU Darmstadt, Hochschulstr. 1, 64289, Darmstadt, Germany, scholz@bwl.tu-darmstadt.de

The facility layout problem is concerned with determining a layout of departments within a building that minimizes the costs of interdepartmental flow of material. In contrast to many traditional approaches, the presented approach incorporates unequal areas and fixed or flexible width to length ratios of departments. We present a MILP-based heuristic which improves initial slicing layouts with all departments positioned at the bottom left of their sites. These initial layouts were generated by a Slicing Tree and Tabu Search (STaTS) approach.

3 - Assembly line balancing with sequence dependent setup times using tabu search algorithm
Nihan Karaca, Industrial Engineering, Istanbul Kultur University, Osman Yilmaz Mah.Millet Cad. Mimoza Apt. Gebze/Kocaeli/Turkey, 41400, Kocaeli, Turkey, karacanihan@gmail.com, Rifat Gürçan Özdemir

This paper presents a study of assembly line balancing with the extension of sequence dependent setup times. We define this innovative problem by formulating as a mixed-integer nonlinear programming model. The paper also develops a tabu search metaheuristic algorithm in order to solve optimal or near optimal task scheduling. The proposed methodology is implemented in an air-condition manufacturer considering sequence dependent setup times with task scheduling of the assembly line balancing problem. The results show that the approach has significant relevance in real-world systems.

TC-20
Tuesday 11:20-12:40
Mann

DEA Methodology IV

Stream: DEA and Performance Measurement

Invited session
Chair: Dimitris Despotis, Department of Informatics, University of Piraeus, 80, Karaoli & Dimitriou Street, 18534, Piraeus, Greece, despotis@unipi.gr

1 - Ranking decision making units with stochastic data
Mohammad Hassan Behzadi, Statistics, Islamic Azad University Science & Research Branch, Department of Statistics, Science & Research Branch, P.O.Box 14515-775, Therhran Iran, 98, Therhran, Iran, Islamic Republic Of, mhbbehzadi@yahoo.com, Farhad Hosseinzadeh Lotti, Mohsen Rostamy-Malkhalifeh, Mahnaz Mirbolouki, Zohreh Moghaddas

DEA is data-oriented performance evaluation method. Cooper et al. have proposed a model with stochastic data and defined the stochastic efficient DMUs. While a suitable model for ranking stochastic efficient DMUs has not been proposed yet. In this paper we have proposed a model, based on modified MAJ with different step lengths, for ranking stochastic efficient the resultant model is a quadratic programming that in which the objective function is a function of level of confidence. An illustrative example is incorporated to demonstrate the result.

2 - The error reduction method for ranking units with stochastic data
Mohammad Hassan Behzadi, Statistics, Islamic Azad University Science & Research Branch, Department of Statistics, Science & Research Branch, P.O.Box 14515-775, Therhran Iran, 98, Therhran, Iran, Islamic Republic Of, mhbbehzadi@yahoo.com, Mahnaz Mirbolouki, Gholam Reza Jahanshahloo, Farhad Hosseinzadeh Lotti, Mohsen Rostamy-Malkhalifeh, Zohreh Moghaddas

In many applications, managers encounter with stochastic data and the necessity of having a method for ranking and evaluating the efficiency of DMUs has been under consideration. In our method DMUs have been assessed while considering a probability for occurrence of not predicted states. Using level of error causes the efficiency to have the essence of probability. In this ranking method, a DMU will have a higher rank if in level of error which is less than that of the managers have determined. It remains stochastic efficient. We have proved the resultant theorems and applied this model on an example.
1 - Monet: algorithmic state of the art (a guided algorithmic tour including practicability stopovers)

Matthias Hagen, Faculty of Media / Media Systems, Bauhaus University Weimar, Bauhausstr. 11, D-99423, Weimar, Germany, matthias.hagen@uni-weimar.de

We give an overview of state-of-the-art algorithmic research on MONET—given an irredundant, monotone DNF and an irredundant, monotone CNF, decide if they are equivalent—and its computational variant. Note that MONET currently is not classified as polynomial or NP-/coNP-hard—a theoretically very interesting issue. Furthermore, MONET solving algorithms are also very important from the point of view of practical applications as equivalent problems are ubiquitous in various fields. We focus on lower bounds for several algorithms and try to shed some light on practical performance.

2 - Polynomial-time dualization of r-exact hypergraphs with applications in geometry

Imran Rauf, Department 1: Algorithms and Complexity, Max-Planck-Institut für Informatik, Germany, irauf@mpi-inf.mpg.de, Khaled Elbassioni

A hypergraph is called r-exact for an integer r>0, if any of its minimal transversal and hyperedge intersect in at most r vertices. We show that the class includes several interesting examples from geometry, e.g., circular-arc hypergraphs (r=2), hypergraphs defined by sets of axis-parallel lines stabbing a given set of \( r \)-fat objects \((r=4t)\), and hypergraphs defined by sets of points contained in translates of a given cone in the plane \((r=2)\). For constant \( r \), we show that all minimal hitting sets for r-exact hypergraphs can be generated in output-sensitive polynomial time.

3 - Specialisation versus diversification in DEA: a new model for non-homogeneous DMUs

Cecilio Mar-molinero, Kent Business School, University of Kent, KBS, University of Kent, CT2 7PE, Canterbury, Kent, cm235@kent.ac.uk

DEA requires that all DMUs must share the same inputs and the same outputs; e.g., it is not possible to compare research institutes, with teaching only institutions, and with traditional universities: traditional universities use a full set of inputs and outputs; research institutes do not have inputs and outputs specific to teaching; and teaching only institutions do not have inputs and outputs that are specific to research. We present a new model that makes it possible to compare, within a unified DEA framework, DMUs that use a full set of inputs and outputs with DMUs that specialise.

4 - Ranking based on inefficient frontier in presence of dmv variables

Mohsen Rostamy-malkhalifeh, Department of Mathematics, Science and Research Branch, Islamic Azad University, hesarakaq, tehran, iran, 96857, tehran, Iran, Islamic Republic Of, mohsen_rostamy@yahoo.com, Zohreh Moghaddas

Traditional DEA can be deemed to identify efficient performers in the most favorable setting which is considered as an optimistic point of view. In real world applications traditional DEA models, reveal that how inefficient a DMU is in the most favorable setting, which does not fit to the real world applications. Inefficient DMUs are those which are in undesirable state that needs to be improved. This paper addresses the issue of ranking in presence of variable which have a nonlinear impact on efficiency based upon comparison to the inefficient frontier.
The efficient supply of spare parts is of prime concern for OEMs. Next to the traditional spare parts sources final order and remanufacturing, the option to buy back broken products prevents the OEM from fulfilling his spare parts availability obligation in the end-of-life phase. For different settings regarding information availability as well as pricing and communication constraints we propose simple MILP models that are able to find optimal buy-back strategies. A numerical study analyzes for which parameter settings the buy-back option can substantially improve the OEM’s performance.

3 - Maintaining an effective inventory

Manbir Sodhi, Industrial & Manufacturing Engineering, University of Rhode Island, Kingston, RI, United States, sodhi@egr.uri.edu

The lifetime of many machines and consumer devices can be extended considerably by planned upgrades of components or parts, contributing to increased sustainability and reduced ownership costs. This concept of operations can require the coordination of a large inventory of entities and components in different states. This talk will examine models that help determine optimal modular upgrade solutions. An analysis of modular replacement decisions for a single machine consisting of several components over an extended time horizon is based on a mixed integer formulation.

3 - Dynamic switching times from season to single tickets in sports and entertainment

Serhan Duran, Industrial Engineering, Middle East Technical University, ODTU Endustri Muhendisligi Bolumu, Ankara Turkey, 06531, Ankara, sduran@ie.metu.edu.tr, Julie Swann

Revenue management can be used in many industries where there is a limited, perishable capacity and the market can be segmented. We focus on the sales of event tickets in the Sports and Entertainment industries, where tickets are sold exclusively as season tickets initially or only as single events later in the selling horizon. We specifically study the optimal time to switch between these market segments dynamically as a function of the state of the system. We find the optimal switching time is a set of time thresholds that depend on the remaining inventory and time left in the horizon.

TC-23

Tuesday 11:20-12:40
Planck

Pricing

Stream: Demand, Pricing and Revenue Management
Invited session
Chair: Demet Cetiner, Mercator School of Management, University of Duisburg-Essen, Lothrstrasse 65 LB 212, 47057, Duisburg, Germany, demet.cetiner@uni-due.de

1 - Price matching and strategic consumer behaviour in dynamic pricing

Yossi Aviv, Olin School of Business, Washington University, Campus Box 1133, 1 Brookings Drive, 63130, Saint Louis, MO, United States, aviv@wustl.edu, Yuri Levin, Mikhail Nediak

We consider a two-period model of duopolistic capacitated dynamic pricing competition when each firm’s strategy can include price matching, and consumer response is strategic. We study the properties of equilibrium strategies, and whether price matching can be an effective tool in countering strategic consumer behavior. Finally, we present the results of an empirical study of the effect of price matching on strategic consumer behavior.

2 - A study on discount pricing policy for perishable products with reference price effects

Takeshi Koide, University of Marketing and Distribution Sciences, 3-1, Gakuen-Nishimachi, Nishi, 6512188, Kobe, Japan, koide@umds.ac.jp, Hiroaki Sandoh

We consider the discount pricing problem of a monopolist firm which sells daily perishable products. When the products would be unsold, they will be marked down at the end of day and the discount sale raises daily revenue for the firm. The discount sale, however, drops consumers’ reference prices, with which the consumers judge if a selling price is a gain or a loss, and lowers revenue in the future. We have formulated the discount pricing problem with reference price effects to show that the number of predicted unsold products significantly influences the optimal policy.

2 - Embedding theorem for fuzzy random two-level linear programming problems

Kosuke Kato, Graduate School of Engineering, Hiroshima University, 1-4-1, Kagamiyama, 739-8527, Higashi-Hiroshima, kosuke-kato@hiroshima-u.ac.jp, Masatoshi Sakawa

In this paper, we focus on fuzzy random two-level linear programming problems (FRTLPPs) with cooperative decision makers (DMs). First, we reformulate a FRTLPP as a stochastic TLLPP (STLLPP), in which the degree of realization of the problem is guaranteed to be greater than or equal to alpha. Second, introducing fuzzy goals for objective functions, we transform the STLLPP into a deterministic TLLPP based on stochastic programming model. Finally, we propose an interactive decision making algorithm to derive a satisfactory solution through interactions with the upper-level DM for the problem.

2 - Embedding theorem for fuzzy random variables and its application to fuzzy stochastic optimization

Monga Kalonda Luhandjula, Decision Sciences, University of South Africa, P O Box 392 UNISA, Pretoria, 0003, Pretoria, Gauteng, South Africa, luhannmk@unisa.ac.za

In this paper, we show that the set of fuzzy random variables can be embedded into a suitable Banach space isomorphically and isometrically. In this way we extend the classical Radstrom Embedding Theorem to fuzzy random variables. A modeling methodology for Fuzzy stochastic Optimization problems based on this fuzzy random version of Radstrom Embedding Theorem is also described. A computational Optimization tool for solving the resulting problem is proposed and numerical examples supplied for the sake of illustration.
3 - Possibilistic-probabilistic optimization: models, methods, applications

Alexander Yazenin, Applied Mathematics Department, Tver State University, Zhelebyava, 33, 170100, Tver, alexander.yazenin@tversu.ru

The paper optimization tasks with fuzzy random parameters are investigated in the possibility-probability context. Combined presentation of uncertainty is explicated with the help of fuzzy random variable model. Approaches for determining second level moments of fuzzy random variables are analyzed. Fuzzy random variables calculus is proposed. As an application example-portfolio analysis tasks that have a fuzzy random variable as a profit model are considered. These tasks are immersed in the possibility-probability context, which allows modelling of investment possibilities more sufficiently.

4 - On infeasibility and pareto-optimality in fuzzy goal programming

Mariano Jimenez-Lopez, Economia Aplicada I, University of the Basque Country, Plaza de Oñati 1, 20018, San Sebastian, Spain, mariano.jimenez@ehu.es, Bilbao-Terol Amelia

The problem of solving a Multiobjective Programming (MOP), by assuming that the Decision Maker (DM) has fuzzy goals, is addressed. We present a method in order to overcome two possible drawbacks in Fuzzy Goal Programming (FGP): infeasibility and saturation. In case of infeasibility the DM does not know the amount by which the tolerance thresholds are surpassed. We supply this information and resolve the infeasibility. In the event of saturation, a fuzzy-efficient solution may not be Pareto-optimal. Our method supplies a solution that is efficient of the MOP and also fuzzy-efficient of the FGP.

TC-25

Tuesday 11:20-12:40

Graphs and Networks

Stream: Cooperative Game Theory

Chair: Sirma Zeynep Alparslan Gök, Scientific Computing, Institute of Applied Mathematics, Middle East Technical University, Institute of Applied Mathematics, Middle East Technical University, 06531, Ankara, Turkey, alzeynep@metu.edu.tr

1 - Robust allocation rules in dynamic cooperative games

Dario Bauso, Dipartimento di Ingegneria Informatica, Università di Palermo, Viale delle Scienze, 90128, Palermo, dario.bauso@unipa.it, Judith Timmer

Classical cooperative game theory is no longer a suitable tool for those situations where the values of coalitions are not known with certainty. We consider a dynamic context where at each point in time the coalitional values are unknown but bounded by a polyhedron. However, the average value of each coalition in the long run is known with certainty. We design "robust" allocation rules for this context, which are allocation rules that keep the coalition excess bounded while guaranteeing each player a certain average allocation (over time).

2 - Monotonicity properties of interval solutions for convex interval games

Mariana Rodica Branzei, Faculty of Computer Science, “Alexandru Ioan Cuza” University, 16, Berthelot St., 700483, Iasi, Romania, branzeir@info.uaic.ro, Stef Tijjs, Elena Yanovskaya

We examine several monotonicity properties of classical single-valued solutions on the class of convex games and their impact on the existence of corresponding interval game solutions. It turns out that the obtained value-type interval solutions on the class of convex interval games inherit most of these monotonicity properties.

3 - The interval Shapley value: an axiomatization

Sirma Zeynep Alparslan Gök, Scientific Computing, Institute of Applied Mathematics, Middle East Technical University, Institute of Applied Mathematics, Middle East Technical University, 06531, Ankara, Turkey, alzeynep@metu.edu.tr

We study properties of the interval Shapley value on the class of size monotonic interval games, and axiomatically characterize its restriction to a special subclass of cooperative interval games by using the properties of additivity, efficiency, symmetry and dummy player.

TC-26

Tuesday 11:20-12:40

Graphs and Networks

Stream: Discrete Optimization

Chair: Agnieszka Rusinowska, CNRS - University of Lyon 2, GATE, 93 Chemin des Mouilles, BP 167, 69131, Ecully, rusinowska@gate.cnrs.fr

1 - A game-theoretic approach to combinatorial optimization

Thorsten Krempasky, Numerische und Angewandte Mathematik, Georg August Universitaet Goettingen, Lotzestraße 16-18, 37083, Goettingen, Germany, krempask@math.uni-goettingen.de, Anita Schoebel

The idea of this work is to combine game theoretical concepts with aspects of optimization. Following this idea, game theoretical methods are applied to optimization problems in order to get a heuristic solution. The results are compared by using the concept of the price of anarchy defined by Roughgarden. Some graph-theoretic problems and the quality of their equilibria are discussed. It turns out that some general statements about games on stable sets and especially on matroids can be proven which give a game theoretical interpretation of well known graph-theoretic concepts.

2 - Connected (n,m)-graphs with maximum zeroth order general Randic index

Ljiljana Pavlovic, Department of Mathematics, Faculty of Natural Sciences and Mathematics, Radioja Domanovica 12, 34000, Kragujevac, Serbia, Serbia, pavlovic@kg.ac.rs, Mirjana Lazic

Let G be a graph and du(u) denote the degree of a vertex u in G. The zeroth-order general Randic index of the graph G is defined as sum of du(u) raised to the power of alpha , where the summation goes over all vertices of G and alpha is a real number. We found for alpha less than 0.5 extremal connected graphs with n vertices and m edges for which this index attains maximum value. Extremal are the fanned pineapple of type 1 graphs.

3 - Random combinatorial optimization problems on hypergraph matchings: limiting optimal values and convergence rates

Pavlo Krokhmal, Mechanical and Industrial Engineering, University of Iowa, 3131 Seamans

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We discuss asymptotical behavior of random combinatorial optimization problems on hypergraph matchings, such as multidimensional assignment problems (Linear MAP, Bottleneck MAP, etc.), whose assignment costs are iid random variables. We investigate convergence of the optimal values of such problems as functions of the problem dimensions. For a broad range of probability distributions of the assignment costs, we demonstrate convergence in $L_1$ and almost surely, establish the convergence limits and the corresponding convergence rates.

4 - Applying relation algebra and relview to measures in a social network

Agnieszka Rusinowska, CNRS - Université of Lyon 2, GATE, 93 Chemin des Mouilles, BP 167, 69131, Ecully, rusinowska@gate.cnrs.fr, Rudolf Berghammer, Harrie De Swart

We present an application of relation algebra to measure players' strength in a network with influence. We deal with power, success, and influence of a player as measured by the Hoede-Bakker index, its generalization and modifications, and by the influence indices. We also apply relation algebra to determine followers of a coalition and the kernel of an influence function. This leads to specifications, which can be executed with the help of the BDD-based tool RelView after a simple translation into the tool's programming language. As an example we consider the present Dutch parliament.

3 - Encoding knowledge in neural networks with probabilistic values

Nuno Miguel Cavalheiro Marques, Dep. Informática, Faculdade Ciências e Tecnologia-Universidade Nova de Lisboa, Campus FCT-UNL, Dep. Informática, 2829-516, Caparica, nmm@di.fct.unl.pt

Propositional core method NeSy neural networks are difficult to train with probabilistic representations of symbols. A standard NeSy network requires 9500 back-propagation iterations to learn an AND truth table with input TRUE values represented by 0.4, while a random initialization of the same network only needs 2700 iterations. We show that by extending the NeSy network with an additional hidden layer, mapping 1:1, only 1700 iterations are needed in this problem. Applications to text and data mining using domain knowledge in neural networks are discussed, namely using neural tagging systems.

TC-27

Tuesday 11:20-12:40

Knowledge Discovery and Data Mining 2

Stream: Knowledge Discovery and Data Mining

Invited session

Chair: Nuno Miguel Cavalheiro Marques, Dep. Informática, Faculdade Ciências e Tecnologia-Universidade Nova de Lisboa, Campus FCT-UNL, Dep. Informática, 2829-516, Caparica, nmm@di.fct.unl.pt

1 - Web access log analysis using a multi-agent approach

António Jorge do Nascimento Morais, Rua Adelino Amaro da Costa, 357 - 1.º Dir. Tras., 4470-225, Maia, ajorgemorais@gmail.com

Web access logs are large repositories of important data, where we can discover user's visiting patterns and recommend other Web pages to follow. This problem is similar to the basket case problem with the difference that a quick real-time response is needed. Agents have embedded data mining algorithms that try to fulfill user's needs. Each agent may specialize itself in a segment of clients and may share knowledge with other agents. They also manage their own financial resources, paying to place recommendations in Web pages and being rewarded when they are followed.

2 - Evaluation of segments of credit card holders

Cristina Martins, Haberb Tec Portugal, Rua Serpa Pinto, 14A, 2º, 1200-445, Lisboa, mciris.martins@gmail.com, Margarida Cardoso

This work presents the segmentation of credit card holders of a Portuguese financial institution. It is focused on the evaluation of the obtained solution via cross-validation. The proposed approach specifically handles a large data set with mixed (numerical and categorical) variables. It both provides the evaluation of the segmentation solution and helps characterizing the segments. Furthermore, it provides classification rules for new credit card holders' segments, helping to support ongoing and future strategic decisions.

2 - Encoding knowledge in neural networks with probabilistic values

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TC-28

Tuesday 11:20-12:40

Modelling Large MIPs

Stream: Modelling Large MIPs

Contributed session

Chair: Oliver Bastert, FICO, Maximilianstr. 35, 80539, Munich, Germany, oliverbastert@fico.com

1 - Solution strategies for hard mip problems

Oliver Bastert, FICO, Maximilianstr. 35, 80539, Munich, Germany, oliverbastert@fico.com

In this talk we describe strategies for solving hard Mixed Integer Programming problems (MIPs). We show how problems which seem intractable can be solved by using different techniques implemented within Xpress. Good strategies for one class of problems may not work on other problem classes and choosing the best strategy is often the key to solving hard MIPs.

2 - Schemes of decomposition and parallelisation in modeling: how to go about solving really large problems?

Susanne Heipcke, Xpress team, FICO, 54 rue Balthazar de Montrou, 13004, Marseille, susanneheipcke@fico.com

This talk presents possibilities for problem decomposition and concurrent solving from a modelling point of view (that is, excluding "parallel MIP" and other solver-internal options). We provide examples of problem classes suitable for the different approaches and hint at their implementation with Xpress-Mosel, using Mosel's capacity of handling multiple models and as a new feature, handling of multiple problems within a single model. Some remarks on the "doability" for less expert modellers close the discussion.

3 - Matrix approach to enterprise performances optimization

Marko Hell, Faculty of Economics, Matice hrvatske 31, 21000, Split, marko.hell@sfst.hr, Stjepan Vidacic, Zeljko Garaca

The Balanced Scorecard (BSC) is a popular concept for performance measurement. The Linear programming (LP) is a mathematical technique for optimization of linear objective functions. The question is: "How to use LP for Enterprise Performances optimization (EPO)?" Answer on this question is contained in this paper. The first step is a matrix presentation of the enterprise performances. The presentation is designed accordingly to BSC concept. Thus formalised recording of enterprise performances will provide the application of LP for EPO.
banks’ clients.
ods to determine the optimal number of buckets in which to cluster
the literature. We extend the analysis by introducing new meth-
that is found to outperform alternative methodologies proposed in
tackling this problem we propose a Threshold Accepting algorithm
side constraints make the clustering problem very complex. For
buckets and computing the mean PD for each bucket. Real-world
PDs can be calculated by clustering credit borrowers into different
Basel II requires banks to hold regulatory capital which may be
pricing scheme for CPDOs is developed.
credit spreads so that its current value fulfills the future obligations.
the portfolio is rebalanced according to mark-to-market changes in
posure to a notional risky portfolio of credit indices. At each step,
have high and rated likelihood of payment, by taking leveraged ex-
are structured credit products aiming at paying high coupons, that
nism of a Constant Proportional Debt Obligation (CPDO). CPDOs
Financial companies still hold structured credit products like CDOs
and CDXs with unknown risk exposure. A Coupled Markov Chain
approach is used to model rating transitions. Heuristics are applied to
find ML estimators. The model is used to simulate scenarios for
joint rating changes and payment streams generated by CDXs or portfolios of contracts. This allows for assessing the risk of current
positions and for designing portfolios which are optimal relative to
risk preferences. We solve classical mean-risk models to obtain op-
timal portfolios of CDXs written on CDXs.

2 - A stochastic model for constant proportional debt
obligations
Viviana Fanelli, DSEMS, University of Foggia, Largo Papa Giovanni Paolo II, 1, 71100, Foggia, Italy, Italy, viviana.fanelli@gmail.com, Silvana Musti

In this paper we propose a model describing the structural mecha-
nism of a Constant Proportional Debt Obligation (CPDO). CPDOs
are structured credit products aiming at paying high coupons, that
have high and rated likelihood of payment, by taking leveraged ex-
poure to a notional risky portfolio of credit indices. At each step, the portfolio is rebalanced according to mark-to-market changes in
credit spreads so that its current value fulfills the future obligations. A numerical algorithm is presented to implement the model and a
pricing scheme for CPDOs is developed.

3 - Optimization heuristics for determining internal rat-
ing grading scales
Johannes Paha, Economics, Justus-Liebig-University Giessen, Lichersstrasse 62, Lehrstuhl VWI I, 35394, Giessen, Hessen, Germany, johannes.paha@wirtschaft.uni-giessen.de

Basel II requires banks to hold regulatory capital which may be
computed from pooled probabilities of default (PD). These pooled
PDs can be calculated by clustering credit borrowers into different buckets and computing the mean PD for each bucket. Real-world
side constraints make the clustering problem very complex. For tackling this problem we propose a Threshold Accepting algorithm that is found to outperform alternative methodologies proposed in
the literature. We extend the analysis by introducing new meth-
ods to determine the optimal number of buckets in which to cluster
banks’ clients.

TC-29

Tuesday 11:20-12:40
GSI - S 2
Credit Risk Modelling
Stream: Financial Modelling
Invited session
Chair: Ronald Hochreiter, Statistics and Decision Support Systems, University of Vienna, Universitaetsstrasse 5, 1010, Vienna, Austria, ronald.hochreiter@univie.ac.at

1 - A coupled Markov chain approach to cdx pricing and optimization
Ronald Hochreiter, Statistics and Decision Support Systems, University of Vienna, Universitaetsstrasse 5, 1010, Vienna, Austria, ronald.hochreiter@univie.ac.at, David Wozaabal

Financial companies still hold structured credit products like CDOs
and CDXs with unknown risk exposure. A Coupled Markov Chain
approach is used to model rating transitions. Heuristics are applied to
find ML estimators. The model is used to simulate scenarios for
joint rating changes and payment streams generated by CDXs or portfolios of contracts. This allows for assessing the risk of current
positions and for designing portfolios which are optimal relative to
risk preferences. We solve classical mean-risk models to obtain op-
timal portfolios of CDXs written on CDXs.

2 - A stochastic model for constant proportional debt
obligations
Viviana Fanelli, DSEMS, University of Foggia, Largo Papa Giovanni Paolo II, 1, 71100, Foggia, Italy, Italy, viviana.fanelli@gmail.com, Silvana Musti

In this paper we propose a model describing the structural mecha-
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credit spreads so that its current value fulfills the future obligations. A numerical algorithm is presented to implement the model and a
pricing scheme for CPDOs is developed.

3 - Optimization heuristics for determining internal rat-
ing grading scales
Johannes Paha, Economics, Justus-Liebig-University Giessen, Lichersstrasse 62, Lehrstuhl VWI I, 35394, Giessen, Hessen, Germany, johannes.paha@wirtschaft.uni-giessen.de

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PDs can be calculated by clustering credit borrowers into different buckets and computing the mean PD for each bucket. Real-world
side constraints make the clustering problem very complex. For tackling this problem we propose a Threshold Accepting algorithm that is found to outperform alternative methodologies proposed in
the literature. We extend the analysis by introducing new meth-
ods to determine the optimal number of buckets in which to cluster
banks’ clients.

TC-30

Tuesday 11:20-12:40
GSI - S 26
Knowledge Discovery for Decision Support II
Stream: Knowledge Discovery for Decision Support
Contributed session
Chair: Milos Jovanovic, Business Decision-Making, University of Belgrade - Faculty of Organizational Sciences, 11000, Belgrade, Serbia, milosj@fon.rs

1 - Continuous time Bayesian networks for diagnosis of
heart disease
Elena Gatti, Department of Informatics, Systems and Communication (DISCo), Università degli Studi Milano Bicocca., Viale Sarca. 336, 20126, Milan, Italy, elena.gatti@disco.unimib.it, Enrico Fagiuoli, Davide Luciani, Fabio Pioltini, Fabio Stella

Several research programs have been developed to assist physicians in reasoning about cardiovascular disorders. In this contribution
a Continuous Time Bayesian Network for reasoning about cardiac
disorders is presented. The main advantage of Continuous Time
Bayesian Networks is that they allow to model systems where there
is no natural time granularity and where the states of some variables vary over time, according to different time scales. Several diagnos-
tic queries are submitted to the Continuous Time Bayesian Network
model to emphasize the relevance of the proposed approach.

2 - Business intelligence model for electronic documents
archive
Dragana Becejski-Vujaklija, IT, Faculty of organizational sciences, Jove Ilica 154, 11000, Belgrade, draganab@fon.rs, Boris Delibasic, Milos Jovanovic

In the situation where base of electronic archiving documents is
large, the user needs to know how many different types of docu-
ments are in the database, which of them are mostly present, etc.
This kind of report is possible to get from an existing database,
but it requires the inclusion of IT specialists. Therefore, there is
an idea to build a new intelligent system which will allow user to
analyze documents without intermediaries and to make managerial
decisions. The result is BI system for the analysis of archived elec-
ronic documents, based on data warehouse.

3 - A "white box" data mining platform for decision sup-
port in decision tree induction algorithm design
Milos Jovanovic, Business Decision-Making, University of Belgrade - Faculty of Organizational Sciences, 11000, Belgrade, Serbia, milosj@fon.rs, Boris Delibasic, Milan Vukicevic

Applications of data mining models are largely influenced by avail-
able software. Abundance of algorithms are implemented to solve various data mining tasks. However, end users are deprived of the
decision support for choosing the right algorithm for the problem at
hand. Opposed to the prevalent “black box” approach, we present a
framework and software support to enable composing of algorithms by combining patterns as solutions for sub-problems within the spe-
cific problem that is data and user driven. We provide performance
evidence for the platform on decision tree induction algorithms.

4 - Data quality provisioning for uncertain decision
support
Sebastian Olbrich, Augustaanlage 34, 68165, Mannheim, BW, sebastian.olbrich@arcor.de, Peter Chamoni
In many applications, imprecise sensor data is analyzed by data mining to guide business decisions. To compute the impact of sensor quality problems on uncertain decision making, we present an architecture for data quality (DQ) management in sensor data warehouses. It supports transfer of DQ information in sensor streams and the quality storage in the target warehouse. We show how DQ information can be used to guide the mining of imprecise sensor data and estimate the quality of mining results at the example of uncertain decision making.

We describe a class of patrolling games on graphs, motivated by the problem of patrolling a facility (museum, airport). The Attacker can choose to attack any node of the graph within a given time interval and requires m consecutive periods there, uninterrupted by the Patroller, to commit his act (and win). The patrolling game is a zero-sum game, where the Value is the probability that the Patroller successfully intercepts an attack. We determine analytically optimal (minimax) patrolling strategies for various classes of graphs, and present numerical results for some intractable cases.

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**TC-31**

Tuesday 11:20-12:40  
GSI - S 34  
Applications of Noncooperative Games  
Stream: Noncooperative Games  
Invited session  
Chair: Juan Tejada, Estadística e Investigación Operativa I, Complutense University of Madrid, Universidad Complutense de Madrid, Plaza de Ciencias, 3, 28040, Madrid, Spain, jtejada@mat.ucm.es

1 - A game theoretic model for channel allocation problems in mobile communication systems  
Joaquin Sánchez-Soriano, Centro de Investigación Operativa, Universidad Miguel Hernández, Elche, Alicante, Spain, joaquin@umh.es, Javier Gozalvez, Alberto Rodríguez-Mayol

Channel allocation schemes are responsible for deciding which available channel is assigned to an incoming call. This work studies a non-cooperative game-theoretic model for channel assignment problems, particularly for FCA (Fixed Channel Allocation) networks. We analyse forward strategies and prove several results about their stability in the sense of Nash equilibria and its refinements. Furthermore, we provide an application example carried out by simulation.

2 - Risk measures of auction models in an electricity market  
Juan Tejada, Estadística e Investigación Operativa I, Complutense University of Madrid, Universidad Complutense de Madrid, Plaza de Ciencias, 3, 28040, Madrid, Spain, jtejada@mat.ucm.es, Estrella Alonso

We have previously obtained a revenue equivalence result of an extensive parametric family of auction models for a simplified duopolistic electricity market. This family contains the classical auction models as well as other new ones. We model the market as a two-person game with incomplete information under the assumption that bidders are symmetric, risk neutral and have independent values. In this communication we explore the behaviour of these auction models regarding some risk measures such as variance, VaR or CVaR. We look for the auction models that minimize the above measures.

3 - A patrolling game for optimising randomised patrols.  
Katerina Papadaki, Operational Research, London School of Economics and Political Science, Houghton Street, WC2A 2AE, London, United Kingdom, k.p.papadaki@lse.ac.uk, Alec Morton, Steve Alpern

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**TC-32**

Tuesday 11:20-12:40  
GSI - S 4  
DMKD advanced applications  
Stream: Data Mining and Knowledge Discovery  
Invited session  
Chair: Yannis Theodoridis, Dept of Informatics, University of Piraeus, 18534, Piraeus, Greece, ytheod@unipi.gr

1 - A temporal text mining application in competitive intelligence  
Haralampos Karanikas, National & Kapodistrian Univ. of Athens, 18534, Athens, Greece, bkaranikas@pbs.uoa.gr, Ioannis Kopanakis

In this paper we describe an application of our approach to temporal text mining in Competitive Intelligence for the biotechnology and pharmaceutical industry. The main objective is to identify changes and trends of associations among entities of interest that appear in text over time. By introducing the term Temporal Text mining our approach combines Information Extraction and Data Mining techniques upon textual repositories and incorporates time and ontologies’ issues.

2 - Knowledge discovery in marketing databases using rough sets theory and self organizing maps.  
Renato Sassi, Industrial Engineering Pst Graduation, Universidade Nove de Julho, Rua Jardimirim, 15, Jardim do Colégio (zona norte), 02431020, São Paulo, São Paulo, rjsassi@gmail.com

Real world databases contain a huge amount of data within which several relations are hidden. These relations are difficult to discover by means of traditional methods such as worksheets and operational informative reports. Therefore, the knowledge discovery systems (KDD) appear as a possible solution to extract, from such relations, knowledge to be applied. This research presents the application and analysis of a hybrid architecture formed by the combination of the Rough Sets Theory with an artificial neural net named Self-Organizing Maps to discover knowledge in marketing databases.

3 - Mining a large xml based event logging system: a case study in telecom  
Sara Safari Vahed, #4, Saami Alley, North Tavanir Street, Tehran, IRAN, 1435743467, Tehran, Iran, Islamic Republic Of, sara.safari.v@gmail.com

XML as a standard for data representation is widely accepted among application developers. One of its applications is in event logging system where each event is represented in the form XML instance using different elements. These XML instances then will be stored in XML files for future use. In Telecom industry where we have millions of transactions every day these XML files will form a huge amount of raw data each day. In this paper we will discuss Data Mining methods for turning these raw data into information useful for applications such as security, marketing and tariff planning.
4 - Suppliers development, a comprehensive model
Zahra Sharafi, Research and Development, MAPNA Group, No. 231, Mirdamad Blvd., 1918953651, TEHRAN - IRAN, 19395/6448, Tehran, Iran, Islamic Republic Of, z.sharafi.a@gmail.com, Jamshid Parvizian

Supplier development involves a decision making problem by which buying firms define priorities to invest on improvement of suppliers. A model is developed to define the strategic importance of a supplier for the buying firm. Data mining techniques are used to cluster the suppliers and determine eligibility of them for developing. The buyer’s requirements and improvement themes are determined by FAST diagram and a roadmap is then developed for each cluster to fill the gap between the current and desired level. The research includes a case study for an Iranian Car Company and its suppliers.

■ TC-33
Tuesday 11:20-12:40
GSI - S 7

Flow Problems
Stream: Linear Optimization
Contributed session
Chair: Hendrik Lambrecht, IAF, Hochschule Pforzheim, Tiefenbronner Str. 65, 75175, Pforzheim, Germany, hendrik.lambrecht@hs-pforzheim.de

1 - Using linear programming to support the investment planning of stochastic flow lines
Katja Schimmelpfeng, Lehrstuhl für Rechnungswesen und Controlling, BTU Cottbus, Postfach 10 13 44, 03013, Cottbus, Germany, katja.schimmelpfeng@tu-cottbus.de, Stefan Helber

This contribution is based on a linear programming approach to simultaneously analyze and optimize flow lines with limited buffer capacities and stochastic processing times. The basic idea is to solve a huge but simple linear program that models an entire simulation run of a multistage production process in discrete time, to determine a production rate estimate. We extend this modelling approach to the investment problem of designing lines such that the net present value of the investment is maximized.

2 - Solving factorized path problems
Marc Pouly, Department of Informatics, University of Fribourg, Bd. de Perolles 90, 3280, Fribourg, marc.pouly@unifr.ch

This article shows how local computation can be used to compute path weights in graphs. The approach is based on the observation that large graphs are more naturally given as decompositions and that only a subset of all paths are required. Starting from a graph decomposition, we continuously compute path weights in small regions using an arbitrary path algorithm and deduce the required total paths from these results. Thus, we considerably reduce the input size of the applied algorithm: the decisive complexity factor is no more the total number of nodes but the induced treewidth of the problem.

3 - Security constrained optimal dispatch via network flow model
Aurelio Oliveira, Computational & Applied Mathematics, State University Of Campinas, DMA IMECC UNICAMP, C. P. 6065, 13081-970, Campinas,
SP, Brazil, aurelio@ime.unicamp.br, Luciana Casacio, Christiano Lyra

In this work, short term hydroelectric scheduling considering security constraints is formulated as a network flow model and solved by interior point methods. The resulting matrix structure is explored leading to very fast iterations since it avoids computation and factorization of impedance matrices. For each time interval, the linear algebra reduces to the solution of a linear system with dimension given by the number of buses whose matrix is invariant and can be factorized off-line. Numerical results for IEEE and Brazilian power systems are obtained using a MATLAB implementation.

■ TC-34
Tuesday 11:20-12:40
GSI - S 8

Linear and nonlinear regression
Stream: Computational Statistics
Invited session
Chair: Pakize Taylan, Mathematics, Dicle University, 21280, Diyarbakır, Turkey, ptaylan@metu.edu.tr

1 - Outlier problems in linear regression
Pakize Taylan, Mathematics, Dicle University, 21280, Diyarbakır, Turkey, ptaylan@metu.edu.tr, Ahmet Kaya

The outlier problem in statistics is oldest and important. Outliers can be defined as observations which may affect model specification and parameter estimation problem. These may lead to taking some wrong models for estimation models. Thus, it is very important in practice to detect, diagnose and remove their effect from observations which are used for statistical modelling. In our study to obtain the best linear model, detection, diagnosis and removing stages will be presented on one example and some conclusions will be given.

2 - Outlier analysis for quality assurance of data
Secil Yalaz, mathematics, dicle university, dicle üniversitesi fen edebiyat fakültesi matematik bölüümü, 21280, diyarbakır, Turkey, syalaz@dicle.edu.tr, Ahmet Kaya

Real data and databases which have to be reliable for estimation process may include some faulty parts. Situations like these events damage the characteristics of data which are called “aberrant condition” and the values which cause these condition are called outliers. The outliers can be defined as observations which affect the estimation and forecasting process in a great extent. In order to take healthy data they are set properly, and is an obligation to destroy or to eliminate the effects of them from observation sets.

3 - Combining regression and exponential smoothing methods for predicting iron ore product grades
Jim Everett, Business School, University of Western Australia, 49 Goldsmith Rd, 6009, Nedlands, WA, Australia, jim.everett@uwa.edu.au

Selecting the mix of iron ore sources to mine and crush requires predicting the resulting grades of lump and fines products to match them to target. Prediction is based on blasthole grades of candidate ore sources, ore type and recent production history. A WLS regression model predicts lump and fines grades. Regression errors are serially correlated across multiple days. An exponential smoothing method removes the serial correlation and greatly reduces the compounded error when stockpiles and cargos are built. The method has been successfully adopted as an aid to iron ore mining in Australia.
Decision-making in business often relies heavily on the process of fitting models to observed data. This process preferably has to be executed in a robust way that circumvents some unreliable data points and uncertainties concerning modeling assumptions. This paper considers the use of non-linear regression with minimal assumptions. Results of experiments exploring robustness based on mixed integer linear programming applications are given.

4 - Experiments with robust techniques for regression models with minimal assumptions

Magdérie van der Westhuizen, School of Computer, Statistical and Mathematical Sciences, North-West University, Private Bag X6001, 2520, Potchefstroom, South Africa, magderie.vanderwesthuizen@nwu.ac.za,

Giel Hattingh, Henkie Kruger

A given set of cogeneration units are operated through a heat-match mode: the priority is to satisfy a heat demand; the excess of electricity is exported to the grid, while the lack of electricity is bought from an electricity market. We establish the best operating mode minimizing the cost of operation for the overall set of cogeneration units. It relies on the merit ordered sequence of marginal costs associated with the different operational modes for each unit. This indicates that the optimal operation of the cogeneration power plant is achieved through an economic dispatch mode.

TC-35

Tuesday 11:20-12:40

GSI - S 9

Energy Prices and Consumption

Stream: Value and Risk in Incomplete Markets

Invited session

Chair: Stefan Schmidt, mathematics, Ruhr University Bochum, Universitätsstraße 150, z.Hd. Gebäude GC 1/59, 44780, Bochum, Germany, smithd@t-online.de

Chair: Martin Rainier, ENAMEC, Glockengasse 15, D-97070 Würzburg, 97070, Würzburg, Germany, rainier@enamec.de

1 - Dealing with uncertainty in energy models using optimization modeling in AIMMS

Ovidiu Listes, AIMMS, Paragon Decision Technology, Schipholweg 1, 2034 LS, Haarlem, Netherlands, o.listes@aimms.com

Inherent uncertainty in energy models can be addressed by techniques like parametric analysis, scenario analysis, stochastic programming or robust optimization. We illustrate how AIMMS modeling system supports such techniques based on a representative energy model. AIMMS can implement the deterministic model and its extensions for dealing with uncertainty in an integrated manner, allowing for evaluation and comparison of solutions. AIMMS support for decision making under uncertainty is further enhanced by powerful graphical representations of both input and output data.

2 - Modeling uncertainty of natural gas consumption

Stefan Schmidt, Fakultät für Wirtschaftswissenschaft, Ruhr-Universität Bochum, Lehrstuhl für Betriebswirtschaftslehre, insb. Unternehmensforschung und Rechnungswesen, Universitätsstraße 150, Gebäude GC, 44780, Bochum, Nordrhein Westfalen, stefan.schmidt@rub.de

Several enactments in energy policy such as the opening of energy markets or the pricing of CO2 emission cause a high degree of competition and increase the importance of accurate forecasts on gas sales volume. Two approaches for this problem will be elaborated and compared. The first idea is a two-step model which applies a stochastic temperature process. The translation of temperature into sales volume is being realized by means of spline functions which are fitted using the least squares method. The second approach disregards influence of temperature and models the sales process directly.

3 - Marginal costs and optimality for cogeneration power systems

Nadia Maïzi, Center for Applied mathematics, Ecole des Mines de Paris, Rue C. Daunennes, BP 207, 06904, Sophia-Antipolis, France, nadia.mazi@ensmp.fr,

Marc Bordier

We develop techniques for the control of call centers with abandonments and retrials in the presence of time-varying arrivals. First, we show that increasing the dimensionality of the state space leads to better control policies. Second, we deal with time-varying parameters by adding them to the state space with a parameterization. These techniques are then applied to the optimal admission control to a call center with a retrial queue with abandonments and time-varying parameters. The numerical experiments show that our techniques have near to optimal performance.

TC-36

Tuesday 11:20-12:40

GSI - S 11

Call center performance models

Stream: Stochastic Models for Service Operations

Invited session

Chair: Ger Koole, Mathematics, VU University Amsterdam, De Boelelaan 1081 a, 1081 HV, Amsterdam, Netherlands, koole@few.vu.nl

1 - Queues with waiting-time dependent service

Thomas Bang Nielsen, DTU Informatics, Technical University of Denmark, Richard Petersens Plads, DTU - Bygningsgade 31, 2800, Kgs. Lyngby, Denmark, tbn@imlab.dtu.dk, Ger Koole, Bo Friis Nielsen

Queues where the service depends on the time customers have spent in queue are common in call centers and also seen in health care. Scenarios as these can be hard to deal with analytically as the used thresholds are often deterministic. A level-crossing approach and an Erlangian approximation are presented from which the waiting-time distribution of customers is obtained.

2 - Analysis of two-level support systems with time-dependent overflow

Michael Manitz, Department of Supply Chain Management and Production, University of Cologne, Universität zu Köln, Seminar für Supply Chain Management and Produktion, 50923, Köln, Germany, manitz@wiso.uni-koeln.de, Raik Stolletz

We analyze the performance of call centers with two levels of support and a time-dependent overflow mechanism. Waiting calls from the front-office queue flow over to a back office, if a waiting-time limit is reached and at least one back-office agent is available. The analysis of such a system is reduced to a continuous-time Markov chain with state-dependent overflow probabilities. To analyze a time-dependent overflow, some waiting-based performance measures are modified. Numerical results demonstrate the reliability of this Markovian performance approximation for different parameter settings.

3 - Control techniques for call centers with abandonments and retrials

Sandjai Bhulai, Department of Mathematics, VU University Amsterdam, De Boelelaan 1081a, 1081HV, Amsterdam, Netherlands, sbhulai@few.vu.nl, Dennis Roubos

We develop techniques for the control of call centers with abandonments and retrials in the presence of time-varying arrivals. First, we show that increasing the dimensionality of the state space leads to better control policies. Second, we deal with time-varying parameters by adding them to the state space with a parameterization. These techniques are then applied to the optimal admission control to a call center with a retrial queue with abandonments and time-varying parameters. The numerical experiments show that our techniques have near to optimal performance.
4 - On service level issues for inbound call centers
Alex Roubos, Department of Mathematics, VU University Amsterdam, De Boelelaan 1081A, 1081 HV, Amsterdam, aroobos@few.vu.nl
The Erlang C formula and its generalizations have quite commonly been used to find the required number of agents such that some service level (SL) criterion is fulfilled. The premise with these formulas is that the system has reached stationarity; something that is not true in reality where SLs are aggregated over intervals not longer than 24 hours. In such small intervals the SL is a random variable. We propose a simple formula for the standard deviation of the SL and use this together with a normal approximation to show highly accurate results.

TC-37
Tuesday 11:20-12:40
GSI - S 12
Multi-Criteria Decision Aids - 1
Stream: Decision Analysis
Contributed session
Chair: Halil Sen, Industrial Engineering, Sakarya University, 54195, adapazari, Turkey, intelicil@gmail.com
A better alternative to weighted sum scoring
Chris Tofallis, Business School, University of Hertfordshire, College Lane, AL10 9AB, Hatfield, Herts., United Kingdom, c.tofallis@herts.ac.uk
The weighted sum is the most common method for creating rankings using multiple criteria. As criteria may be measured in different units and have very different magnitudes, they are normalized before being combined. Various ways of normalizing are used. But even when the same (e.g. equal) weights are used, these options lead to different rankings! The reasons for this will be explained. We look at the multiplicative method of aggregation. Here normalization is not required - the problem is avoided. We illustrate with data on universities and compare features with weighted sum scoring.

2 - Fleet replacement policies in theory and practice
Patrick Tobin, School of Arts and Sciences (Vic), Australian Catholic University, Victoria Pde, Fitzroy, 3065, Melbourne, Victoria, patrick.tobin@acu.edu.au
This paper draws on a case study where a fleet of vehicles were needed a reliable and cost efficient turnover policy. It was expected that this would be a direct tradeoff between rising costs and replacement costs. In undertaking the work some surprising results emerged on maintenance matters which meant that criteria other than direct economic balancing needed to be dealt with. This paper examines the issue and a resolution strategy.

3 - Mda group preferences modeling under incomplete information:
Halil Sen, Industrial Engineering, Sakarya University, Adapazari, 54195, adapazari, Turkey, intelicil@gmail.com, Ibrahim Cil
Today’s decision making problems are discrete, multicriteria, and involve multiple decision makers (DMs). Organizations use the GDM techniques because of the problem’s complexity. One of the key questions in this type of problems is how the preferences of the DMs can be modelled. DMs are able to provide only incomplete information, because of time pressure, lack of knowledge, and their limited expertise related to the problem domain. In these type of problems the DSS should allow modelling of the incomplete preference information. In this study we use an interactive DSS for the MES selection problem.

TC-38
Tuesday 11:20-12:40
GSI - S 13
Bilevel programming: applications
Stream: Variational Inequalities and Bi-Level Problems
Invited session
Chair: Diana Fanghaenel, Institut für Informatik, Universitätsplatz 2, 50969, Köln, Germany, Fanghaenel@informatik.uni-koeln.de
1 - A heuristic algorithm for optimizing frequencies in a transit network
Ricardo García, Escuela Superior de Informatica, Universidad de Castilla La Mancha, Paseo de la Universidad, 4, 13007, Ciudad Real, Ciudad Real, Spain, ricardo.garcia@ucm.es, Eusebio Angulo Sánchez-Herrera
This paper dealt with the problem of optimizing frequencies in a transit network in the context of medium-term planning. It is assumed that the size of the fleet can be a variable and requires to be decided. The model is formulated as a bi-level optimization problem. An heuristic algorithm for the integer bilevel model has been proposed. It is based on the optimality conditions of Karush-Kuhn-Tucker (KKT). A computational experience on the rapid transit network of Seville has been carried out. The convergence of the algorithm is shown in the numerical tests.

2 - A hierarchical approach for water system planning
Carmen Galé, Métodos Estadísticos, Universidad de Zaragoza, CPS, Edificio Torres Quevedo, María de Palafox, Zaragoza, Spain, cga@unizar.es, Herminia I. Calvete, Pedro Mateo
A usual situation facing water resource planners is to determine which of alternative configurations for the water system has to be implemented. Difficulties arise to establish measures of the system performance which take into account the different interests of the water system users. Moreover, planners can use their influence to modify the users’ behavior favoring sustainable use of water by fixing taxes. In order to analyze the impact of alternative configurations, we formulate a bilevel model which deals with the hierarchical framework involved and develop an algorithm to solve it.

3 - Optimization methods with convex and concave support functions in bilevel programming
Oleg Khamisov, Applied Mathematics, Institute of Energy System, Siberian Branch of the Russian Academy of Sciences, Lermontov street, 130, 664033, Irkutsk, khamisov@isem.sei.irk.ru
In our presentation we describe how a global optimization approach with convex and concave support functions can be applied to solving bilevel programming problems in optimistic sense. The approach is based on the branch and bound scheme. Different lower bounding procedures and convergence conditions are described and discussed. Preliminary computational results are given.

4 - Piecewise linear and piecewise quadratic finite-element approximation of hemivariational inequalities
Nina Ovcharova, Institute of Mathematics, Department of Aerospace Engineering, Universität der Bundeswehr
München, Werner-Heisenberg Weg 39, 85777, Neuiberg, nina.ovcharova@uni-bw.de

We present a convergence analysis for piecewise linear and piecewise quadratic finite-element approximation of hemivariational inequalities, arising in Mechanics and Engineering in connection with non-convex energy functionals or non-monotone possibly multivalued friction laws. First we give an existence result for an abstract coercive nonlinear variational problem. Then, using smoothing approximation via convolution we investigate the discretization of the nonlinear functional through different quadrature rules. At the end, we present computational results.

**■ TC-39**

*Tuesday 11:20-12:40*  
GSI - S 14  
Mergers and acquisitions in the banking sector in Europe  
Stream: Operational Research and Quantitative Models in Banking  
*Invited session*  
Chair: Alain Chevalier, FINANCE, ESCP-EAP, 79 Avenue de la République-PARIS-75011-FRANCE, 75011, PARIS, FRANCE, chevalier@escp-eap.net

1 - Consolidation in the European pharmaceutical industry  
Gupta Jyoti, FINANCE, ESCP-EAP, 79 Avenue de la République, 75011, Paris, Paris, France, gupta@escp-eap.net

The paper analyzes some questions related to M&A activity in the European pharmaceutical sector: What are the characteristics of this industry and its importance in the European economy? What factors affect the profitability of the sector? What are the consolidation forces? Does the consolidation in the sector leads to a decrease in R&D output? Two M&A cases (Bayer-Schering, Sanofi-Aventis) are used to illustrate the forces behind the consolidation process. An attempt is made to assess whether value was created by the acquisition and to investigate the existence of abnormal returns.

2 - A systemic approach of the bank crisis in Europe  
Alain Chevalier, FINANCE, ESCP-EAP, 79 Avenue de la République-PARIS-75011-FRANCE, 75011, PARIŠ, PARIS, France, chevalier@escp-eap.net, Pierre Kunsch

The sub-prime crisis in the USA has triggered a bank crisis of till-now unknown gravity around the world and particularly in Europe. In this article a systemic analysis is proposed of the genesis of the crisis, its consequences, and the adequacy of measures taken by the European governments to avoid the collapse of major banks, and to protect investors, clients, borrowers, and shareholders. A specific case will be highlighted to illustrate the analysis.

3 - Value creation, quality improvement and motivation optimisation: the case of the beer industry concentration in Europe  
Alain Chevalier, FINANCE, ESCP-EAP, 79 Avenue de la République-PARIS-75011-FRANCE, 75011, PARIS, FRANCE, chevalier@escp-eap.net, Pierre Kunsch

Beer producers in Western Europe were selling nationally or regionally before M&A created increasingly capital intensive and competitive multinational firms. The claim for better quality increased. Cases are presented and analysed by means of a systemic frame-work integrating multi-criteria decision-making. It is shown that, after an acquisition, a merger may be superfluous, in case improvements in both quality and staff motivation are made. These findings are in line with observations in other industries and world regions.

4 - The role of the payment methods in M&A deals: the bnp paribas case study  
Alain Chevalier, FINANCE, ESCP-EAP, 79 Avenue de la République-PARIS-75011-FRANCE, 75011, PARIS, PARIS, France, chevalier@escp-eap.net, Etienne Redor

Many theories have been developed to explain the choice of the payment method in mergers and acquisitions (cash, stock or mixed offer of cash and stocks). The BNP-Paribas-Société Générale deal constitutes an ideal example to explore this choice, because Société Générale and BNP have both used stocks and then a mix of cash and stocks in their tender offers. This deal also allows us to study the role of a payment method that is less frequently used in M&A deals: the contingent value right.

**■ TC-40**

*Tuesday 11:20-12:40*  
GSI - S 27

Business Process Modelling and Simulation  
Stream: Simulation Based Decision Support  
*Invited session*  
Chair: Miro Gradisar, Univ. of Ljubljana, Faculty for Economy, Kardeljeva ploščad 17, 1000, Ljubljana, Slovenia, miro.gradisar@if.uni-lj.si

1 - Business process modeling and simulation requirements in project oriented small and medium enterprises (smes)  
Igor Perko, Faculty of Economics and Business, Razlagova 14, 2000, Maribor, Slovenia, igor.perko@uni-mb.si

For the projects implementation in the project-oriented SMEs the partners, and the human, material, and financial resources are used. The time component of the internal and external resources use is especially important. New methods and technologies in the field of business processes modeling and simulation (BPMs) support the accurate planning and enable the dynamics in using the resources. In the paper the BPMs requirements in the project-oriented SMEs are elaborated and compared to the R&D state in the field of BPMs to determine the application potentials and the open research issues.

2 - Simulation approach for measuring benefits of business process renovation  
Jure Erjavec, Informatics, Faculty of Economics, Kardeljeva ploščad 17, 1000, Ljubljana, jure.erjavec@ef.uni-lj.si, Miro Gradisar, Peter Trkman

Business process renovation has often been used as an approach for reducing costs, lead-times and increasing the quality of the processes. However, the companies have difficulties in assessing the benefits of the renovation (both ex ante and ex post) due to either lack of time and resources or simply because of the inherent complexity of the processes. Using a case study of a manufacturing process renovation we show how business process simulations can be used to assess the benefits of renovation and thus optimizing it. On the basis of the simulations further renovation suggestions are made.
We consider workflows of time-consuming tasks whose processing order is constrained by precedences. Often, the task durations can be influenced by the assignment of resources. This leads to the problem of selecting an optimal resource allocation, where optimality is measured by network characteristics such as the makespan. In this talk, we study a robust resource allocation problem where the impact of resource assignments on task durations is uncertain. After discussing the complexity of the problem, we provide an iterative solution method and present an application in digital circuit design.

3 - Optimizing the modifications regularity in a multi-project system
Zohar Laslo, Industrial Eng. & Management, Sami Shamoon College of Engineering, Bialik/Bazel Sts., 84100, Beer Sheva, Israel, zohar@sce.ac.il
We deal with controlling and modifying multiple project systems under inadequate information about real-time conditions and the payoff outcomes of actions in a dynamic environment. Since the single project has no control over the system’s constrained resources, project programs’ modifications should be synchronized. Time commitments, budgets, resource capacities and possibilities of adjusting them to the projects’ expected requirements during the course of their life-cycle, determine the most expedient modifications regularity that is found via a system dynamics framework of simulations.

■ TC-42
Tuesday 11:20-12:40
GSI - S 3

Topics in Macroeconomic Modelling
Stream: Mathematical Models in Macroeconomics
Invited session
Chair: Claus Neidhardt, Mathematik und Technik, FH Koblenz - RheinAhrCampus Remagen, Südallee 2, 53424, Remagen, neidhardt@rheinahrampus.de

1 - Equilibrium states in market simulation
Claus Neidhardt, Mathematik und Technik, FH Koblenz - RheinAhrCampus Remagen, Südallee 2, 53424, Remagen, neidhardt@rheinahrampus.de
In an oligopoly or a polypoly two natural types of equilibrium states occur, the first being the Nash equilibrium, the other being the social optimum. In a simple model, both equilibrium types can be generated in a computer simulation. The type that is eventually attained depends on the modeling of the decision process. It is even possible to generate mixed states, where some firms attain the Nash equilibrium while others attain a modified social optimum. An interesting question is, which percentage of the firms is necessary to tilt the whole market towards the Nash equilibrium.

2 - The impact of estimation risks on capital allocation
Gabriel Frahm, Statistics & Econometrics, University of Cologne, Meister-Ekkehart-Straße 9, 50937, Cologne, frahm@statistik.uni-koeln.de
Capital market theories, like the Capital Asset Pricing Model or the Arbitrage Pricing Model, presuppose, that the investor has complete information about the probability distribution of asset returns. But the investors are actually exposed to estimation risks or even to model risks. In this talk we will show important results in portfolio optimization in consideration of estimation risk, and we will discuss potential implications with regard to the validity of the conventional capital market theories.

3 - Keen economics
Jürgen Kremer, FB Mathematik und Technik, FH Koblenz RheinAhrCampus Remagen, Südallee 2,
A cornerstone of standard economics, the theory of the firm, is usually derived erroneously. If the errors are corrected, nearly nothing of substance remains.

Some results of Steve Keen are emphasized with model calculations and a connection to game theory is established.

4 - Property rights, real options and social asymmetries

Dirk Löhr, Umwelt-Campus Birkenfeld, Fachhochschule Trier, Postfach 1380, 55761, Birkenfeld, Rheinland-Pfalz, stbloehr@aol.com

Normally externalities are considered as being the most important reasons for market failure. Asserting this, economic textbooks forget an even more important aspect: the costs of lost flexibility in an uncertain world, if investments have a real option structure. This kind of costs sets an additional hurdle for the profitability of investments. If the costs of lost flexibility do not go hand in hand with an advantage for the investor, economy might be kept away from welfare optimum. These aspects matter for assets such as money, land, patents etc.

TC-43
Tuesday 11:20-12:40
GSI - S 10
Building sustainable communities

Stream: Sustainable living: Cognitive, Social, Economical, Ecological and World View

Invited session

Chair: Ali Gökmen, Department of Chemistry, Middle East Technical University, 06531, Ankara, Turkey, agokmen@metu.edu.tr

Chair: Inci Gokmen, Chemistry, Middle East Technical University, METU Department of Chemistry, 06531, Ankara, Turkey, igokmen@metu.edu.tr

1 - Solutions through community participation

John Croft, Institute of Sustainability & Technology Policy, Murdoch University, South St., Murdoch, WA 6150, Perth, Western Australia, jdcroft@yahoo.com, Ali Gökmen

The global economic crisis is the worst since 1929. Peak oil threatens oil dependent transport. Of the 6.8 tonnes of CO2 emission/capita we can sustain only 2. Population grows nearly 100 million/year, straining forests, fisheries and water supplies. Many want government or corporate solutions, but without community mandate little can be done. Mobilizing community creativity, liberating the power to make a difference, is needed. METU Turkey has created 8 projects using a system pioneered in Australia. Used in USA, Africa and Europe, if allowed to grow, this can build true sustainability.

2 - Transformation of a traditional village in Turkey to an economically sustainable community

Ali Gökmen, Department of Chemistry, Middle East Technical University, 06531, Ankara, Turkey, agokmen@metu.edu.tr, Inci Gökmen

In Ankara 9000 tons of vegetables are consumed daily and most of these are transported from other regions. The yearly food transportation to Ankara generates about 100-thousand tons of CO2. Instead, the villages nearby Ankara may provide healthy food for Ankara with the awareness created among rural and urban people, empowering village woman and young people as well as man. The project consists of four steps: a dreaming circle, planning, doing and celebration. A project team with participation of all the actors is formed for transforming a village to an economically sustainable community.

3 - Education for creating sustainable communities

Iinci Gökmen, Chemistry, Middle East Technical University, METU Department of Chemistry, 06531, Ankara, Turkey, igokmen@metu.edu.tr, Ali Gökmen

Ecovillages are communities living ecologically in harmony with nature. Global Ecovillage Network extending from Europe to the whole world. There is exchange of information and training in network. Global Ecovillage Educators for Sustainable Earth has initiated the Gaia Education with curricula in the ecovillage design education (EDE) and sustainable community development. EDE covers social, economy, ecology and world-view. International Workshop on Sustainable Living and Planning for Sustainability were organized. Trainees of these workshops are creating new networks of sustainability.

TC-44
Tuesday 11:20-12:40
GSI - S 16
Climate, Energy and Uncertainty

Stream: Uncertainty and Environmental Decision Making

Invited session

Chair: Olivier Bahn, GERAD and HEC Montréal, 3000 Chemin de la Côte-Sainte-Catherine, H3T 2A7, Montréal, Qc, Canada, olivier.bahn@hec.ca

1 - A stochastic game approach to the optimal timing of regional climate policies

Olivier Bahn, GERAD and HEC Montréal, 3000 Chemin de la Côte-Sainte-Catherine, H3T 2A7, Montréal, Qc, Canada, olivier.bahn@hec.ca, Laurent Drouet, Alain Haurie, Roland Malhamé, Julien Thénie

The elaboration of efficient climate policies must involve many countries. However, climate policies must also take into account the inherent uncertainty associated in particular with possible technological breakthrough to abate efficiently GHG emissions. We propose here a stochastic game model as a paradigm for the design of optimal timing of abatement. The presentation is organized as follows. First, we present our approach for a single world player. Second, we present an extension for m regions. Strategic behavior of these regions is studied using different dynamic game formalisms.

2 - The endogenous price dynamics of emission permits in the presence of technology change

Marc Chesney, Swiss Banking Institute, University of Zurich, 8032, Zurich, Switzerland, chesney@isb.uzh.ch, Luca Taschini

Characterizing relevant companies with endogenous pollution processes, this paper extends Chesney and Taschini(2008). We assess how relevant companies decide to undertake pollution-reduction investments in a permit market. The equilibrium price of emission permits is derived by introducing different abatement alternatives and modeling explicitly the strategic interaction of relevant companies. By investigating investment-behaviors and analytically specifying trading strategies, we state formally under which conditions a firm provides a correct abatement.

Chair:

Olivier Bahn, Qc, Canada, olivier.bahn@hec.ca,

Alain Haurie, Qc, Canada, olivier.bahn@hec.ca,
3 - Integrating behavioral pattern uncertainties in techno-economic energy and environmental planning models  
Gustavo Nguene, HEG, 7 route de Drize, 1227, Carouge, Geneva, Switzerland, gustavo.nguene@epfl.ch, Emmanuel Fragniere, Roman Kanala, Denis Lavigne, Francesco Morenino

In the classical framework of MARKAL, energy technologies are competing to reach cost objectives and environmental constraints. Recent international studies indicate that practical sustainable development scenarios will be feasible if essentially grounded on human behavioral involvement. Consequently, we propose a new MARKAL formulation (SOCIAL MARKAL) that embeds both technological and behavioral contributions to the environment. We will present the first results of a MARKAL scenario integrating comprehensive social patterns. Reporting issues for decision makers will also be discussed.

4 - The simulation and optimization of technology to address climate change  
Gary Howorth, Energy-Redefined, 1626 Colonial Hills Drive, 22102, Mclean, VA, United States, gary.howorth@verizon.net

Climate change when coupled with the interaction of politics is an incredibly complex system. Optimization or control of such a system using conventional techniques is difficult and fraught with a myriad of issues. The paper will consider a number of models that the author has explored in industry to help frame key questions in the current climate debate. This has involved consideration of policy, technology, and the modeling of carbon emissions. The author’s current approach uses a combination of methods including complexity approaches. Initial results from the model will be presented.

TC-45
Tuesday 11:20-12:40
GSI - S 33

II : A Societal Complexity and Sustainable Development

Stream: Methodology of Societal Complexity
Invited session

Chair: Fernanda Strozzi, Quantitative Methods Institute, Cattaneo University-LIUC, Corso Matteotti, 22, 21053, Castellanza, Varese, Italy, fstrozzi@liuc.it

1 - Ethical aspects of societal complexity: the contribution of discourse ethics  
John Mingers, Kent Business School, Kent University, CT2 7PE, Canterbury, Kent, United Kingdom, j.mingers@kent.ac.uk

With globalization, environmental problems and significant failures in corporate governance, ethics is perceived to be of increasing importance. This paper argues that Habermas’s discourse ethics (DE) can make a significant contribution. After outlining some major ethical theories, the paper describes DE. DE is different from other approaches to ethics as it is grounded in actual debates between those affected by decisions. Recognizing that the theory is rather abstract, the final section discusses how it can be pragmatized, with the help of existing soft/critical OR/Systems methodologies.

2 - A methodology for sustainable development  
Cathal Brugha, Management Information Systems, University College Dublin, Quinn School of Business, Belfield, 4, Dublin 4, Ireland, Cathal.Brugha@ucd.ie

We show that sustainable development requires balance between one’s subjective position and objective realities, and between one’s inner world and outer world. These form a meta-structure based on four dimensions that operate embedded within one another: Adjusting Self within Adjusting World, within Convincing, within Committing. We use the model to show that for development to be sustainable it must follow reverse processes: adapting in the face of objective realities as in conflict resolution, evincing appropriate world views, and inducing what is best for long term success.

3 - Manmade project: diagnosing vulnerability, emergent phenomena, and volatility in manmade networks  
Fernanda Strozzi, Quantitative Methods Institute, Cattaneo University-LIUC, Corso Matteotti, 22, 21053, Castellanza, Varese, Italy, fstrozzi@liuc.it, Eugenio Gutierrez, David Arrowsmith

MANMADE is an EU funded project (1.1.2007-31.12.2009). A general overview of the project as well as some specific results will be presented. The main scope of the project covers the mathematical methods required to understand the dynamics of the network of networks that comprise Europe’s critical infrastructure such as electricity grid, supply chain, transport and commercial networks such as the electricity market. The main problems of the interconnected networks considered were vulnerability and risk, resilience, feedback and scaling.

4 - Triple loop learning - a complementarist systems approach to management  
Slavica P. Petrovic, Faculty of Economics, University of Kragujevac, D. Pucara 3, 34000, Kragujevac, Serbia, Serbia, pslavica@kg.ac.yu

In contemporary circumstances, people have to manage increasing diversity of issues by using increasing diversity of theories, methodologies, methods. The key issue refers to a way of choice making between theories, methodologies, methods. Diversity Management (DM), as a complementarist metatheory, tries to provide a base of guidelines for choice making. DM is built into a complementarist methodological idea of Triple Loop Learning (TLL). TLL is focused on managing three issues (about design—how, debate—what, power and legitimacy—why) together in order to enable a responsible action.

Kathleen M. Dowling
Tuesday 12:55-14:15

**TD-01**

**Tuesday 12:55-14:15**  
Beethoven  
**EURO Doctoral Dissertation Award**  
Stream: EDAA  
*Invited session*  
Chair: Denis Bouyssou, CNRS-LAMSAD, France, bouyssou@lamsade.dauphine.fr

1 - Advances in mip - new tricks for the bag  
_Tobias Achterberg, R&D, ILOG, Ober-Eschbacher Strasse 109, 61352, Bad Homburg, Germany, tachtenberg@ilog.de_

We give an overview on new solver ingredients that extend the state-of-the-art in mixed integer programming. These components have been incorporated into the constraint integer programming solver SCIP, which has been developed during the PhD research of the author. SCIP is available in source code and free for academic use. The talk focuses on a few highlights of SCIP ingredients and evaluates their computational impact.

2 - Heuristics for stochastic vehicle and inventory routing problems  
_Lars Magnus Hvattum, Industrial Economics and Technology Management, Norwegian University of Science and Technology, Alfred Getz veg 3, Sentralbygg 1, N-7491 Trondheim, Norway, 7491, Trondheim, Lars.M.Hvattum@iot.ntnu.no_

We first consider a stochastic and dynamic vehicle routing problem from a real world transportation company. Heuristic solution methods are created based on the use of sample scenarios to capture the stochastic elements of the problem. Second, a stochastic inventory routing problem is approached by using scenario trees to approximate infinite horizon Markov decision process formulations. Heuristic solution methods are used to handle the subproblems. Large computational tests are presented to illustrate the performance of the different solution methods.

3 - Interval methods for competitive location problems  
_Boglarka G.-Toth, Differential Equations, Budapest University of Technology and Economics, Egry Jozsef u. 1., 1111, Budapest, Hungary, bog@math.bme.hu_

This thesis contributes to several Operations Research fields: global optimization, multisubjective optimization and location science. Shortly, in this thesis general reliable methods both for uni- and biobjective optimization problems are developed and/or accelerated, which can be applied to any continuous optimization problems. To prove the applicability of the methods, several competitive facility location problems have been solved with them. These problems have been modelled very close to reality, which are also results of this thesis contributing to the field of location science.

**TD-02**

**Tuesday 12:55-14:15**  
Schumann  
**Metaheuristics for Transportation Planning II**  
Stream: Transportation Planning  
*Invited session*  
Chair: Karl Doerner, Department of Business Studies, University of Vienna, Brienner Strasse 72, 1210, Vienna, Vienna, Austria, karl.doerner@univie.ac.at

1 - Ant colony optimization for the order batching problem  
_Soeren Koch, Fakultät für Wirtschaftswissenschaften, Otto-von-Guericke-Universität Magdeburg, Lehrstuhl für Management Science, Universitätsplatz 2, 39106, Magdeburg, Germany, Soeren.Koch@WW.Uni-Magdeburg.DE, Gerhard Wäscher_

One of the major planning problems in the context of manual order picking is the grouping of customer orders into picking orders, the so-called order batching. In the past mainly constructive heuristics have been suggested to solve this problem. The authors present in detail the application of a metaheuristic, namely Ant Colony Optimization, to the order batching problem. Based on extensive numerical experiments it is shown that the use of this metaheuristic leads to significant improvements in solution quality compared to classical solution approaches.

2 - Tabu search and the attribute based hill climber for the order batching in walk-and-pick order picking systems  
_Sebastian Henn, Faculty of Economics and Management, Otto-von-Guericke University Magdeburg, Universitätsplatz 2, 39106, Magdeburg, sebastian.henn@ovgu.de, Gerhard Wäscher_

Order picking is a warehouse function dealing with the retrieval of articles from their storage location in order to satisfy a demand specified by customer orders. One of the planning problems in this context is the transformation of customer orders into picking orders, where customer orders are grouped, such that the order picker’s total travel time is minimal. It will be presented, how Tabu Search and the Attribute Based Hill Climber Heuristic can be applied to this Order Batching Problem. The talk concludes with a performance comparison of both approaches to existing solution algorithms.

3 - Variable neighborhood search for the dial-a-ride problem  
_Karl Doerner, Department of Business Studies, University of Vienna, Brienner Strasse 72, 1210, Vienna, Vienna, Austria, karl.doerner@univie.ac.at, Sophie Parragh, Richard Hartl_

In dial-a-ride problems passengers have to be transported between pre-specified pickup and delivery locations under user inconvenience considerations. The problem variant considered in this talk aims at minimizing travel costs while respecting maximum route duration limits, time windows, and maximum user ride time limits. We propose a competitive variable neighborhood search based heuristic, using four classes of neighborhoods. We report best results for 15 out of 20 benchmark instances.

4 - Ant colony optimization for the single line train scheduling problem  
_Marc Reimann, Department of Statistics and Operations Research, University of Graz,
A wireless sensor network is based on the collaborative effort of distributed autonomous devices called sensors. Sensors have limited energy and capability for sensing, data processing and communication. We develop a mixed-integer linear programming model to maximize network lifetime by optimally determining sensor and sink locations, with the objective of maximizing the network survival time, which indicates how long the network keeps functioning. In this study, we introduce a new model for a wireless sensor network in two-dimensional grid with multiple base stations. The model decides both the optimal flow of data and the locations of the base stations, or only the optimal flows for a given set of base station locations, with the objective of maximizing the network survival time. Using this model, we evaluate and analyze the performance of some heuristic movement strategies for base stations.

One of the issues in designing wireless sensor networks is the network survival time, which indicates how long the network keeps functioning. In this study, we introduce a new model for a wireless sensor network in two-dimensional grid with multiple base stations. The model decides both the optimal flow of data and the locations of the base stations, or only the optimal flows for a given set of base station locations, with the objective of maximizing the network survival time. Using this model, we evaluate and analyze the performance of some heuristic movement strategies for base stations.

### TD-03

**Tuesday 12:55-14:15**

**Reger**

**Wireless sensor networks**

**Stream:** Network Optimization

**Invited session**

Chair: Kadir Ertogral, Industrial Engineering Department, TOBB University of Economics and Technology, Sogutozu cd. No:43, 06560, Ankara, Turkey, kertogral@etu.edu.tr

1 - Optimal placement, activity scheduling and routing in wireless sensor networks

I. Kuban Altinel, Industrial Engineering Dept., Bogaziçi University, Bebek, 34342, Istanbul, Turkey, altinel@boun.edu.tr, Yavuz Turkogullari, Necati Aras

A wireless sensor network is based on the collaborative effort of distributed autonomous devices called sensors. Sensors have limited energy and capability for sensing, data processing and communication. We develop a mixed-integer linear programming model to maximize network lifetime by optimally determining sensor and sink locations, sensor-to-sink data routes and activity schedules of the deployed sensors over a given horizon subject to coverage, flow conservation, energy consumption and budget constraints. We also propose valid inequalities increasing the quality of the formulation.

2 - Deterministic deployment of wireless sensor networks

Charl Ras, Electrical and Electronic Engineering, University of Melbourne, Parkville, 3010, Parkville, Victoria, charl@ee.unimelb.edu.au, Doreen Thomas, Marcus Brazil

We propose a new heuristic for deterministic deployment of wireless sensor networks when 1-connectivity and minimum cost are the two competing objectives. Given a set of data sources and a base station, our aim is to introduce the minimum number of relays to the network so that every sensor is connected to the base station. Our heuristic is based on the GEOSTEINER algorithms for the Steiner minimal tree problem, and proves to be much more accurate than the current best heuristics for the 1-connected deployment problem, especially in the case of sparse data source distributions.

3 - Evaluating energy efficiency of heuristic base station movement strategies in wireless sensor networks with mobile base stations

Kadir Ertogral, Industrial Engineering Department, TOBB University of Economics and Technology, Sogutozu cd. No:43, 06560, Ankara, Turkey, kertogral@etu.edu.tr, Muhammed Rasit Yildiz

We study the application of Ant Colony Optimization (ACO) to the Single Line Train Scheduling Problem, where trains may originate in any of the terminal and intermediate stops along the line and travel in both directions. Given some tentative timetable for the trains the objective is to find a conflict-free timetable, with the minimum possible deviation from the tentative one. A conflict arises, when two trains try to occupy the same line segment between two stations at the same time. We apply different versions of ACO and provide some first results on the viability of our approach.

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### TD-04

**Tuesday 12:55-14:15**

**Liszt**

**Flow-Shop Scheduling Problems**

**Stream:** Scheduling

**Invited session**

Chair: M. Rosario Moreira, Faculdade de Economia, Universidade do Porto, Rua Dr. Roberto Frias, s/n, 4200-464, Porto, Portugal, mrosario@fe.up.pt

1 - Minimizing the number of tardy jobs in a flowshop scheduling problem with setup times and time lags constraints

Emna Dhouib, Quantitative Methods, Faculté des sciences économiques et de gestion, université de Sfax, Route de mahdia km 8.5, Markez Essebi, chez l’épiciер Moncef Ben Amor, 3054, Sfax, emna_dhouib@yahoo.fr, Jacques Teghem, Taicir Loukil

We consider the flowshop scheduling problem with sequence dependent setup times and time lags constraints to minimize the number of tardy jobs. Dependent setup times are defined as the work to prepare the machines between two successive jobs. Time lags are defined as an interval of time that must exist between pairs of consecutive operations of the same job. Such constraints arise in various production systems. We propose a mathematical programming formulation and a simulated annealing to solve the problem and we compare both approaches on several instances.

2 - Flowshop rescheduling under different types of disruptions

Ketrina Katragjini, INSTITUTO TECNOLÓGICO DE INFORMÁTICA, UPV- Ciudad Politécnica de la Innovación, Camino de Vera s/n-Edif. Bldg. 8G Acc. B, 46022, Valencia, Spain, ketrina@iti.es, Eva Vallada, Ruben Ruiz

Almost all manufacturing facilities need to use production planning and scheduling systems to increase productivity and reduce production costs. Real-life production operations are subject to a large number of unexpected events like machine breakdowns or new job arrivals. In all these cases, rescheduling is essential for minimizing the impact in the performance of the system. In this work we present reactive rescheduling algorithms that obtain a good trade-off between maximum completion time and stability. Different types of events are used for disrupting and simulating the real schedules.

3 - Attribute based hill climbing for the no-wait flowshop scheduling problem with flow-time objective

Andreas Fink, Chair of Information Systems, Helmut-Schmidt-University, Holstenhofweg 85, 22043, Hamburg, Germany, andreas.fink@hsu-hamburg.de
Attribute based hill climbing is a memory-based metaheuristic. Local search moves are enabled depending on solution attributes’ aspiration levels. We apply attribute based hill climbing for the no-wait flow-shop scheduling problem with flow-time objective. Computational experiments provide further evidence for the effectiveness of attribute based hill climbing. We analyze the influence of different design decisions on the performance of the algorithm.

4 - Greedy randomized (gr) dispatching heuristics for the single machine scheduling problem with quadratic earliness and tardiness penalties

M. Rosario Moreira, Faculdade de Economia, Universidade do Porto, Rua Dr. Roberto Frias, s/n, 4200-464, Porto, Portugal, mrosario@fep.up.pt, Jorge Valente

In this paper, we present GR dispatching heuristics for the single machine scheduling problem. The several heuristic differ on the strategies involved in the construction of the GR schedules and on whether they employ only a final improvement step, or perform a local search. They were compared with existing procedures, as well as with optimum solutions for some instance sizes. The computational results show that the proposed procedures clearly outperform their underlying dispatching heuristic, and the best of these procedures provide results that are quite close to the optimum.

3 - Protein function prediction from protein-protein interactions. new insights using fuzzy logic algorithms

Antonio Gómez, Bioinformatics and Molecular Biology, Institut de Biotecnologia i Biomedicina (IBB) Universitat Autònoma de Barcelona, 08193, Barcelona, Spain, anttomo@gmail.com, Enrique Querol, Juan Cedano

Functional annotation of proteins is a fundamental problem in the post-genomic era; the availability of protein interaction networks for many species has increased the number of computational methods for interpreting such data to study protein function. In this work, we have developed a simple Fuzzy Logic algorithm that integrates the data from several interaction networks approaches (Module-assisted schemes, Network topology methods, Graph clustering methods) in order to gain knowledge and understanding about the protein function and the network where its included.

Bioinformatics V

Stream: Computational Biology, Bioinformatics and Medicine

Invited session

Chair: Metin Turkay, Department of Industrial Engineering, Koc University, Rumelifeneri Yolu, Sariyer, 34450, Istanbul, Turkey, mturkay@ku.edu.tr

1 - Classification of cancers using gene expression signatures

Youssef Masmoudi, Sfax University, BP 954, 3042, Sfax, Tunisia, youssef_m_tn@yahoo.fr, Metin Turkay

Biomarker detection is usually by oncologist to detect cancers. For this reason, dimension reduction or variable selection is used to determine some genes to use. In this study, we use all genes expression to classify cancers. Indeed, classification techniques become more and more powerful and with reasonable processing time. One algorithm of Support Vector Machine (SVM) called LibSVM was used and performed with WEKA (a powerful and open source tool for data mining). Some dataset from the literature was used. The misclassification errors arrive to 0% in some dataset.

2 - Mixed-integer model formulation for the image registration problem

Michael Stiglmayr, Institute of Mathematics, University of Wuppertal, Gauldistr. 20, 42119, Wuppertal, Germany, stiglmayr@math.uni-wuppertal.de, Kathrin Klamroth

Registration of medical images is an important as well as challenging task. We present the use of generalized linear assignment problems for registration and their correspondence to a quadratic assignment problem formulation. These models of the registration problem may, in some cases, be solved to global optimality and are therefore independent of any preregistration. The convergence of the point matching problem to a variant of the Monge-Kantorovich problem is introduced. Computational results are presented as well as an outlook on applications of point matching in medical image analysis.
Yield uncertainty in influenza vaccine production affects decision making processes in the vaccine supply chain. Information asymmetry among supply chain participants adds to the complexity, and causes certain inefficiencies. We model information asymmetry in the flu supply chain with yield uncertainty, and design an optimal menu of contracts that the vaccine buyer (the government) can offer to the supplier (the manufacturer) in order to induce efficiency, and produce a system optimal vaccine volume.

3 - A fuzzy data-based dss for humanitarian response to natural disasters in developing countries

I. Tinguaro Rodriguez, Department of Statistics and Operational Research, Complutense University of Madrid, Plaza de Ciencias, 3, 28040, Madrid, Spain, jtrodrig@mat.ucm.es, Begoña Vitoriano, Javier Montero

We present a decision support system (DSS) developed to aid decision makers inside those Non-Governmental Organizations (NGOs) devoted to humanitarian response to natural disasters taking place in developing countries. It combines a fuzzy approach together with a data-based methodology in order to extract and build rules of inference from large databases of historical disaster scenarios. These rules give decision makers the capability to predict the consequences of forthcoming disasters, then allowing NGOs to reduce their response time when facing the strike of a natural disaster.

4 - A lexicographical goal programming model for transport of humanitarian aid in developing countries

Gregorio Tirado, Estadística e Investigacion Operativa I, Universidad Complutense de Madrid, Plaza de Ciencias, 3, 28040, Madrid, Spain, gregoriotd@mat.ucm.es, M. Teresa Ortuño, Begoña Vitoriano

Natural and man-made disasters have been affecting increasing numbers of people throughout the world. When a major disaster strikes a country, international community usually respond with an outpouring of assistance, which has to be efficiently managed to give a quick answer under adverse conditions. Organizations are demanding decision support tools for humanitarian logistics taking into account their specific characteristics. A goal programming model focusing on the transport problems to distribute humanitarian aid to the affected population of a disaster in a developing country is presented.

Recoverable robustness is a concept to avoid over-conservatism in robust optimization by allowing a limited recovery after the full data is revealed. We consider a new recoverable robust shortest path problem, in which the costs of the arcs are subject to uncertainty, modeled by scenarios. In the Exact Subgraph-RRSP problem we are interested in a sub graph with minimal number of arcs containing for every scenario a shortest path of the original graph.

We show that the problem is not approximable with a factor better than m, unless P=NP and that his bound is tight.

2 - Robustness through branch-and-cut and uncertain set covering problems

Michele Monaci, D.E.I., University of Padova, Via Gradenigo 6/A, 35131, Padova, Italy, monaci@dei.unipd.it, Matteo Fischetti

We consider optimization problems in which the input data is uncertain and face them by means of a robust optimization approach based on branch-and-cut. Moreover, we consider a variant of the well-known set covering problem for which branch-and-cut is the most natural way to face with the problem. Similar situations arise for the uncertain version of several other combinatorial optimization problems that have a set-covering like formulation. Computational experiments on both instances from the literature and on randomly generated instances are provided.

3 - Computational considerations of the probability-robustness

Ricardo Garcia, Escuela Superior de Informatica, Universidad de Castilla La Mancha, Paseo de la Universidad, 4, 130071, Ciudad Real, Ciudad Real, Spain, ricardo.garcia@ucm.es, Angel Martin, Juan A. Mesa, Federico Perea, Doroteo Verastegui

This papers analyzes the computational complexity of finding p-robust solutions. The concept of p-robustness was introduced in an earlier paper, and is applied to transportation network designs in which the set of scenarios follows a probability distribution. In this work we address the computational face of this concept, and provide new procedures to find both p-robust solutions and the p*-robustness of a problem.

4 - Linear recovery problems with application in train platforming

Sebastian Stiller, Institut für Mathematik, Technische Universität Berlin, 10623, Berlin, Berlin, Germany, stiller@math.tu-berlin.de, Laura Galli, Paolo Toth, Alberto Caprara

Recoverable robustness shall remedy the short-comings of classical robust optimization for applications which allow limited recovery. We show that the model stays tractable for linear programming recovery. This yields a general method for network buffering, by which it is easy to extend an existing algorithm for the nonmonomial problem to an algorithm for the robust problem. We exemplify this in a train platforming problem. Trains must be assigned to platforms plus in- and out-paths. Replacing heuristic methods for robustness with our approach, delay reduces on real-world data by about 25%.
Lotsizing and Scheduling

Stream: Supply Chain Management

Invited session

Chair: Herbert Meyr, Chair of Production and Supply Chain Management, Technical University of Darmstadt, Hochschulstr. 1, 64289, Darmstadt, Germany, Meyr@bwl.tu-darmstadt.de

1 - Simultaneous lotsizing and scheduling for multiple production stages

Florian Seeanner, Rechts- und Wirtschaftswissenschaften, Fachgebiet Produktion & Supply Chain Management, Hochschulstr. 1, 64289, Darmstadt, Germany, seeanner@bwl.tu-darmstadt.de, Herbert Meyr

In consumer goods industries there is typically a large number of final items to be produced on stock. This is often done in a two or three-stage production system, like make&pack, with parallel, sequence-dependent production lines per stage. For the case of shifting bottlenecks, Meyr formulated the General Lotsizing and Scheduling Problem for Multiple production Stages (GLSPMS). In this talk we restate this model and present some reformulations. Finally, heuristic approaches basing on these reformulations are proposed and preliminary computational results are shown.

2 - Product blending and product shipment in an integrated oil company

Sigrid Lise Nonås, Finance and Management science, Norwegian School of Economics and Business Administration, Helleveien 30, 5045, Bergen, Norway, sigrid-lise.nonas@nhh.no, Jens Bengtsson

We here consider the product blending and product shipment problem in an integrated oil company. We discuss how to better coordinate the blending and shipment of product with the scheduling of the other activities in the supply chain. In the literature known and fixed values are general assumed for the parameters present in the product blending- and shipment models. We here consider how to value and use these to better integrate the product blending- and shipment with the other operations in supply chain. We also briefly discuss how to handle unexpected events in the proposed model.

3 - Lot-sizing within internal supply chains

Alexander Dobhan, Lehrstuhl für Produktion und Logistik, Universität Bamberg, Feldkirchenstr. 21, 96045, Bamberg, Germany, Alexander.Dobhan@uni-bamberg.de

The organisation of internal supply chains is determined very often by a combination of hierarchical and heterarchical components. Considering the trend to autonomous factories, hybrid planning strategies seems to be appropriate for intra-organisational multi-site-planning. Therefore, the intention of this paper is to present a new, quantitative, and hybrid approach for intra-organisational multi-site lotsizing. This approach is developed for avoiding some of the disadvantages of centralised and decentralised planning strategies such as missing optimality or high complexity.

4 - The economic lot and supply scheduling problem: models and solutions

Heinrich Kuhn, Chair of Production Management, Catholic University of Eichstaett-Ingolstadt, Auf der Schanz 49, 85049, Ingolstadt, Germany, heinrich.kuhn@ku-eichstaett.de, Thomas Liske

The paper presents an overview on the variety of models concerning the Economic Lot and Supply Scheduling Problem (ELSSP). The ELSSP deals with the simultaneous vehicle routing and production lot-sizing problem assuming continuous demand of the end product items. In distinction from the ELSP, the production of the end items requires end item specific input-materials, which have to be sourced from geographically dispersed suppliers. The talk describes the different cases, formulates the specific models, outlines the solution schemes, and demonstrates numerical results.

Quality Management

Stream: Supply Chain Management

Invited session

Chair: Yue Dai, Management Science, Fudan University, 670 Guoshun Road, 200433, Shanghai, yuedai2002@gmail.com

1 - The management of processes in maintenance

Slavica Jovetic, Management and Business Economy, Faculty of Economics, Djure Pucara Starog 3, 34 000, Kragujevac, Serbia, sjovetic@kg.ac.yu, Nenad Stanisic

In this paper TQM idea is applied on processes in maintenance in an organization. The paper suggests and develops the methodology of management and improvement (MI) of process in the enterprises which have quality management system (QMS). It consists of the parts that represent the stages of continuous MI in maintenance: defining and documenting of process; statistical, engineering and management methods; managing of financial indicators of the QMS; performance measures, preventive and corrective actions and organization of continuous MI processes in maintenance and their performances.

2 - On the optimization of quality and maintenance decisions using a variable-parameter shewhart chart

George Nenes, Mechanical Engineering, Aristotle University of Thessaloniki, University Campus, P.O. Box 461, 54124, Thessaloniki, Greece, gennes@auth.gr, Sofia Panagiotidou

We present a model for the economic design and optimization of a Variable-parameter X-bar Shewhart control chart used in a process where, apart from quality shifts, failures may also occur. Quality shifts result in poorer quality outcome, higher operational cost and higher failure rate. Thus, their removal, besides improving the quality of the outcome and reducing the quality cost, is also a PM action since it reduces the probability of a failure. The proposed model’s optimum parameters and minimum cost are compared against the respective parameters and cost of a Fixed-parameter chart.
and speed. Show that SAPI obtains a good balance between quality solutions and real time. In this talk, we present a new solution scheme called SAPI. This method performs a statistical analysis of propagation of events. Finally, two applications in railways and commercial aviation (challenge ROADEF 2009) are exposed. The results concern events. Finally, two applications in railways and commercial aviation (challenge ROADEF 2009) are exposed. The results

may make an original plan suboptimal or infeasible. Disruption management is a methodology that deals with these disruptions in real time. In this talk, we present a new solution scheme called SAPI. This method performs a statistical analysis of propagation of incidents to reduce the problem and concentrate the effort in concerned events. Finally, two applications in railways and commercial aviation (challenge ROADEF 2009) are exposed. The results show that SAPI obtains a good balance between quality solutions and speed.

Transport Timetabling

Stream: Timetabling and Rostering

Invited session

Chair: Rodrigo Acuna-Agost, LIA - Laboratoire de Informatique, Université d’Avignon, 339, chemin des Meinajaries, Agroparc BP 1228, 84911, Avignon, PACA, France, rodrigo.acuna-agost@univ-avignon.fr

1 - Determining railway timetables according to users’ desires and fleet size constraints

Miguel Angel Pozo, Alcalde Isacio Contreras, Nº8, 1ºA, 41003, Seville, miguel.pozo@us.es, Juan A. Mesa, Francisco A. Ortega

In this paper, we consider the train timetabling problem for a single railway line, taking into account both operator’s and user’s interests. For the users, a timetable is suitable if it enhances transfer conditions and fits to their ideal boarding time. Firstly, a fitting function for evaluating riders disarrangements is defined in the paper. Secondly, a preestablished fleet size and a generical origin-destination matrix dependent on time give rise to a demand allocation problem. Transfer synchronization constraints at fixed points in time are also included in the problem formulation.

2 - An ant colony algorithm for the train timetabling problem of MRT

Jenyu Huang, Department of Civil Engineering, National Taiwan University, No. 1, Sec. 4, Roosevelt Road, 10617, Taipei, Taiwan, m09303001@chu.edu.tw, Jau-Ming Su

The train timetabling problem aims at determining a periodic timetable for a set of trains that doesn’t violate track capacities and satisfies some operational constraints. In this paper, we define the train timetabling problem of MRT and propose an algorithm which based on ant colony optimization with local search for solving the problem. A case study using the data of Taipei MRT demonstrates the algorithm’s effect and its potential applications. The result indicates a free conflict timetable of MRT can be produced efficiently and the proper proportion of headway of timetable is more than 90%.

3 - Sapi - a new solution scheme in disruption management

Rodrigo Acuna-Agost, LIA - Laboratoire de Informatique, Université d’Avignon, 339, chemin des Meinajaries, Agroparc BP 1228, 84911, Avignon, PACA, France, rodrigo.acuna-agost@univ-avignon.fr.

Philippe Michelon, Dominique Feillet, Serigne Gueye

In the execution phase, unexpected events disturb the system and may make an original plan suboptimal or infeasible. Disruption management is a methodology that deals with these disruptions in real time. In this talk, we present a new solution scheme called SAPI. This method performs a statistical analysis of propagation of incidents to reduce the problem and concentrate the effort in concerned events. Finally, two applications in railways and commercial aviation (challenge ROADEF 2009) are exposed. The results show that SAPI obtains a good balance between quality solutions and speed.

MCDA applications in business and management

Stream: Multiple Criteria Decision Analysis

Invited session

Chair: Michael Doumpos, Dept. of Production Engineering and Management, Technical University of Crete, University Campus, 73100, Chania, Greece, mdoumpos@dpem.tuc.gr

1 - An integrated quantitative framework for active equity portfolio engineering

Panagiotis Xidonas, Electrical & Computer Engineering, National Technical University of Athens, 9 Heroon Polytechniou Str., 15780, Athens, pxid@epu.ntua.gr, Fotis Petropoulos, George Mavrotas, Christos Ntanos, Konstantinos Nikolopoulos, Dimitris Askounis, John Psarras, Vasilis Assimakopoulos.

We advocate for the necessity of introducing an integrated quantitative framework, fully implemented in a functional window-based information system, to support active investment decisions. The proposed approach combines the THETA forecasting method for selecting the most attractive securities, along with the augmented ε-constrained (AUGMECON) multiobjective mathematical programming (MMP) method for synthesizing optimal portfolios. Our objective is to engineer equity portfolios that offer consistent outperformance relative to underlying benchmarks, with strict control of portfolio risk.

2 - On artificial intelligence and multicriteria decision analytics to engineer a predictive school classification system

Nina Kajiji, National Center Public Education, University of Rhode Island, 80 Washington Street, 02903, Providence, Rhode Island, United States, Nina@uri.edu, Gordon Dash, Elliot Krueger.

This research employs Kohonen (K) and radial-basis-function (R) neural networks to uncover the policies that best explain variation in high school mathematics and English arts proficiency. We interrogate a subjective school classification system by extraction of a 3 by 1 (K) feature map. Next, predictive school performance is sorted by estimating a softmax-based probabilistic Cobb-Douglas production function based on an (R) network. Under AI-MCDA US public school administrators are empowered to more effectively predict and sort expected school performance within statutory regulations.

3 - Evolutionary optimization approaches for building outranking models in credit risk rating

Michael Doumpos, Dept. of Production Engineering and Management, Technical University of Crete, University Campus, 73100, Chania, Greece, mdoumpos@dpem.tuc.gr, Constantin Zopoulos.

Credit risk rating involves the development of classification models that facilitate the assessment of the likelihood of default. Multi-criteria methods have been used in this domain, based mainly on value function models. In this paper, outranking techniques are employed, which enable the development of non-compensatory relational models that take into account veto and incomparability conditions. Evolutionary optimization, namely the differential evolution algorithm, is used for the development of the models based on a set of training data.
Approximation and stability
Stream: Stochastic Programming

Invited session
Chair: Georg Pflug, Department of Statistics and Decision Support Systems, University of Vienna, Universitaetsstrasse 5, A-1010, Vienna, Austria, georg.pflug@univie.ac.at
Chair: Silvia Vogel, Mathematics and Natural Sciences, Ilmenau University of Technology, Postfach 100565, 98684, Ilmenau, Thuringia, Germany, Silvia.Vogel@tu-ilmenau.de

We investigate a general approach, which derives confidence sets for solutions of decision problems as suitable neighborhoods of solutions of approximate random problems. The method relies on special convergence properties of the objective functions and the constraint sets. In order to determine the radius of the neighborhoods, knowledge about certain characteristics of the unknown true decision problem is needed. We will show how estimates for these characteristics can be included into the considerations.

Stochastic optimization - sample path rate of stability

Petr Lachout, Dept. Probability and Statistics, Charles University in Prague, Sokolovská 83, 186 75, Praha, Czech Republic, lachout@karlin.mff.cuni.cz

This talk deals with stochastic optimization problems. We will present results on a rate of stability for "optimal value" and "optimal solutions". Results are derived without measurability assumption and, also, uniqueness is not assumed.

Approximation and optimal scenario generation for stochastic programs

Georg Pflug, Department of Statistics and Decision Support Systems, University of Vienna, Universitaetsstrasse 5, A-1010, Vienna, Austria, georg.pflug@univie.ac.at

While typically stochastic programs are defined using general stochastic processes modeling the uncertainty, the solution of such programs is based on simple discrete tree approximations. By using appropriate distances for the stochastic scenario processes we demonstrate quantitative stability results for optimal values and solutions. These distances incorporate not only the difference in values but also the difference in information of the two processes in one single number. We also show how these types of stability results may be used for scenario generation.

Location in supply chains
Stream: Location Analysis

Invited session
Chair: H.a. Eiselt, University of New Brunswick, P.O. Box 4400, E3B 5A3, Fredericton, NB, Canada, haeiselt@unb.ca

1 - Contribution to location — allocation problem of supply chain units to the structural industry section

Pericles Fylakis, Aristotle University of Thessaloniki, 76 V. Alexandrou, 57200, Lagadas Thessaloniki, Greece, pfylakis@civil.auth.gr

The facility location problem in the sector of heavy structural industry, constitutes an important part of strategic planning in the field of enterprises dealing with the constructional sector. Existence of a supporting tool in the decision making for the above mentioned problem constitutes an inquiry for the managers of this area. Use of overtime employment in the structural projects production is usual and rather imposed for the installation of units with smaller possible capacity. In this paper an effort was made for the most optimal solution to the problem making use of this ability.

2 - Location and policy analysis for intermodal transport in Belgium

Cathy Macharis, Department of Mathematics, Operational Research, Statistics and Information Systems for Management, Free University of Brussels, Brussels, Belgium, Belgium, Cathy.Macharis@vub.ac.be, Ethem Pekin

We describe a geographic information system-based location model to analyse characteristics of the Belgian intermodal terminal landscape. Based on transportation costs, the model compares intermodal transport with unimodal road transport. It visualises the current intermodal terminal landscape, and simulates various scenarios, like introducing new terminals or effects of subsidies. Highlighting the market areas of inland waterways and rail terminals, the model is used as a policy support tool to obtain integrated visions on future intermodal transport development in Belgium.

3 - Optimizing subsidies for the location of facilities

H.a. Eiselt, University of New Brunswick, P.O. Box 4400, E3B 5A3, Fredericton, NB, Canada, haeiselt@unb.ca, Joy Bhadury

The presentation deals with a model that has three levels: a regional planner, who attempts to maximize his tax revenue and who can award subsidies, a firm that locates branches in order to maximize its profit, and customers, who have posted a fixed demand. It is demonstrated that this bilevel optimization problem has a computable solution. Tests on U.S. data reveal some interesting properties of the solutions. A variety of extensions is also discussed, including a generalization of the probel to multiple regions, and the value of information.
Behavioral Kernels of Inventory Management

Stream: Inventory Management

Invited session

Chair: Mirko Kremer, SC/IS, The Pennsylvania State University, 460 Business Building, 16802, University Park, PA, United States, muk22@psu.edu

1 - Over- and underreaction in time series forecasting

Mirko Kremer, SC/IS, The Pennsylvania State University, 460 Business Building, 16802, University Park, PA, United States, muk22@psu.edu

Demand forecasting as behavioral kernel for inventory (and many other planning) decisions encompasses the daunting challenge of separating stability from change. In a controlled laboratory environment, we investigate human performance in a time series forecasting task. We document fairly predictable patterns of human reactions to the demand signals generated by the underlying demand process.

2 - Supply chain coordination with information sharing in the presence of trust and trustworthiness

Guido Voigt, Production and Logistic, Otto-von-Guericke University, Postfach 4120, 39016 Magdeburg, 39016, Magdeburg, Germany, guido-voigt@gmx.de

The strategic use of private information causes efficiency losses in traditional principal-agent settings. Yet, a growing body of studies highlights the importance of communication, trust and trustworthiness in supply chain management. The underlying work links the concepts of communication, trust and trustworthiness to a traditional principal-agent setting. It can be shown that communication and trust can lead to substantial efficiency losses although there is a substantial level of trust and trustworthiness.

3 - Designing contracts for supply chains with irrational but predictable newsvendors

Michael Becker-Peth, Seminar für Supply Chain Management und Management Science, Universität zu Köln, Albertus Magnus Platz, 50923, Köln, NRW, Germany, michael.becker-peth@uni-koeln.de, Ulrich Thomenmann

In contract design, sellers optimize the contract parameters under the assumption that the buyers are placing orders that maximize their expected profits, a decision commonly referred to as rational. However, in various experiments it has been shown that buyers do not determine orders rationally. In our research, we first conduct a number of experiments to analyze the buyers’ order behavior. We demonstrate that the orders quantities of buyers are not expected profit maximizing, but that they can be predicted quite accurately and build on this information to design various contracts.

Resource-Constrained Project Scheduling

Stream: Project Management and Scheduling

Invited session

Chair: Christian Artigues, LAAS, CNRS, 7 avenue du Colonel Roche, 31077, Toulouse Cedex 4, artigues@laas.fr

1 - A multi-population genetic algorithm for the resource constrained project scheduling problem

José Fernando Gonçalves, LIAAD, Faculdade de Economia, Universidade do Porto, Rua Dr. Roberto Frias, s/n, 4200-464, Porto, Portugal, jfgoncal@fep.up.pt

This paper presents a new multi-population genetic algorithm for the Resource Constrained Project Scheduling Problem, able to provide close to optimal solutions for large instances. The approach combines a serial schedule generation scheme (SGS) with a genetic algorithm. The genetic algorithm is based on random keys and is responsible for evolving the priorities used by the serial- SGs. Forward-backward improvement is applied to every solution. Extensive computational tests on benchmark problems validate the effectiveness of the proposed approach. Supported by FCT project PTDC/EIE/72244/2006.

2 - A new fast complete method for resource-constrained project scheduling

Andrei Horbach, Institute of Business Administration, University Kiel, Olshausenstrasse 40, D-24098, Kiel, Germany, horbach@bwl.uni-kiel.de

We formulate the resource-constrained project scheduling problem (RCPSP) as series of instances of the satisfiability problem and adapt a satisfiability solver for the specific domain of the problem. Applying our solver we close several benchmark instances of the RCPSP that have never been closed before by proving tighter lower bounds and by finding better feasible solutions. Our solver shows an one to two orders of magnitude better performance on several hard benchmark instances from the library PSPLIB than other existing complete RCPSP solvers from the literature.

3 - Modeling and solving resource-constrained project scheduling problems with ibm ilog cp optimizer

Philippe Laborie, ILOG, an IBM Company, 9, rue de verdun, 94253, Gentilly, France, laborie@fr.ibm.com

Since version 2.0, IBM ILOG CP Optimizer provides a new scheduling language supported by a robust and efficient automatic search. We will show how the main features of resource-constrained project scheduling such as work-breakdown structures, optional tasks, different types of resources, multiple modes and skills, resource calendars and objective functions such as earliness/tardiness, unperformed tasks or resource costs can be modeled in CP Optimizer. The robustness of the automatic search will be illustrated on some classical resource-constrained project scheduling benchmarks.

4 - Event-based MILP models for the resource-constrained project scheduling problem

Christian Artigues, LAAS, CNRS, 7 avenue du Colonel Roche, 31077, Toulouse Cedex 4, artigues@laas.fr, Oumar Kone, Pierre Lopez, Marcel Mongeau, Marcel Mongeau
We make a comparative study of several mixed integer linear programming (MILP) formulations for the resource-constrained project scheduling problem (RCPSP). First, we present standard discrete and continuous time MILP formulations. Second, instead of relying on the traditional discretization of the time horizon, we propose two new MILP formulations based on the concept of event: the Start/End and the On/Off formulations. Experimental results allow us to provide guidelines for the choice of the accurate formulation with respect to the RCPSP instance characteristics.

**Multiple Criteria Integer Programming**

Stream: Multi-Objective Optimization and Decision Theory

**Invited session**

Chair: Ralf Borndörfer, Optimization, Zuse-Institute Berlin, 14195, Berlin, Germany, borndoerfer@zib.de

1. **An exact method to generate the non-dominated set for the moilp problem**

Chergui Mohamed El-Amine, Recherche Opérationnelle, Université des Sciences et de la Technologie H.B., BP. 32, Bab Ezzouar, 16111, Algeria, ALGERIE., Algeria, mohamedelaminec@yahoo.com, Ait-mehdi Meriem, Abbas Moncef

We describe an exact method to generate the non-dominated set for the MOILP problem. While most of researchers solve initially an ILP problem, the proposed method starts with an optimal point of an LP problem and uses a branching process to find locally an integer point. Then, an efficient cut which deletes only dominated vectors is built. The results show that our method is better than Sylva & Crema’s one since it’s 15 times faster, makes thrice less simplex iterations and generates almost 4 times fewer nodes on average. As an application, the artificial insemination problem is treated.

2. **An approximation algorithm to generate the extreme supported nondominated points for multiobjective mixed integer programs**

Ozgur Ozpeynirci, Department of Logistics Management, Izmir University of Economics, 35330, Izmir, Turkey, ozgur.ozpeynirci@ieu.edu.tr, Murat Koksakul

We consider finding the extreme supported nondominated (ESN) points for multiobjective mixed integer programming problems. We develop an approximation algorithm (ApA) that generates a representative subset of ESN points. ApA keeps lower and upper bound sets for ESN points and provides a nonincreasing worst case proximity measure between the bound sets. This property allows ApA to provide a performance guarantee. We develop lower bound sets and variations of the algorithm to enhance its computational performance and demonstrate the results on a set of assignment problems.

3. **Multiobjective integer optimization in public transportation**

Ralf Borndörfer, Optimization, Zuse-Institute Berlin, 14195, Berlin, Germany, borndoerfer@zib.de

This talk discusses multi-criteria versions of Lagrangean relaxation and column generation optimization approaches to optimization problems in public transportation including line planning, vehicle scheduling, and duty scheduling. In this way, we can analyze trade-offs between conflicting objectives such as quality of service, operational stability, and employee satisfaction.

**Cutting and Packing 6**

Stream: Cutting and Packing

**Invited session**

Chair: Socorro Rangel, DCCE, UNESP, Rua Cristovão Colombo, 2265, 15054000, S.J. do Rio Preto, São Paulo, Brazil, socorro@ibilce.unesp.br

1. **Large scale production planning in the stainless steel industry**

Janne Kurelahi, Accenture, Finlaysoninkuja 21 A, 33210, Tampere, Finland, janne.kurelahi@accenture.com, Pekka Vainiomäki, Tapio Westerlund

We introduce a new formulation for a two-dimensional trim loss problem in the stainless steel industry. In this model, the dimensions of the mother coils are considered variables. To enable reuse of scrap material, the trim loss at the end of a coil is collected into a single coil. Also, the scattering of an order to multiple coils is minimized to facilitate shipping. For numerical solution, the inherently non-linear problem is transformed to a linear one by a decomposition technique. The procedure has been successfully applied in industrial environment at Outokumpu Stainless Tornio Works.

2. **Skiving stock problem**

Martina Stubner, Uni Bonn, Rheinische Friedrich-Wilhelms-Universität Bonn, Wegeler Str. 10, 53115, Bonn, Germany, martina.stuber@uni-bonn.de

In this talk we will discuss the so-called Skiving Stock Problem. This problem appears by the manufacturing paper rolls and was first described by Eugen Zak. It describes the situation where by technical reasons the customer’s orders can not be executed. This means that the desired length of the ordered paper roll is to be cut more than a half the roll length. The technical solution is to cut one jumbo roll into smaller rolls and to skive these rolls to the desired roll length. A mathematical model of this problem will be given and some properties of this model will be discussed.

3. **Arc-flow model for the two-dimensional cutting stock problem**

Rita Macedo, Departamento de Produção e Sistemas, Universidade do Minho, Universidade do Minho, Escola de Engenharia, Departamento de Produção e Sistemas, Campus de Gualtar, 4710-057, Braga, Portugal, rita@dps.uminho.pt, Cláudio Alves, J. M. Valério de Carvalho

We describe an exact model for the two-dimensional Cutting Stock Problem with two stages and the guillotine constraint. It is a linear programming arc-flow model, formulated as a minimum flow problem. We explicitly consider all its variables and constraints, apply reduction criteria to reduce the size and symmetry of the model and solve it with CPLEX, considering a new family of cutting planes. We also consider some variants of the original problem. The model was tested on a set of real instances from the wood industry, with promising results.

4. **The two-dimensional cutting stock problem with saw machine set ups**

Socorro Rangel, DCCE, UNESP, Rua Cristovão Colombo, 2265, 15054000, S.J. do Rio Preto, São Paulo, Brazil, socorro@ibilce.unesp.br, Gabriela Mosquera, Horacio Yanasse
In this paper we present solution approaches to the two-dimensional cutting stock problem considering both the minimization of the total number of plates and the cutting machine set ups. The relationship between the number of cutting patterns and the number of saw cycles (machine set ups) is studied. Results of a computational study using real data from a Brazilian furniture plant are also presented. Acknowledgement: Brazilian agencies CNPq and FAPESP.

Given two clusters of points, the Support Vector Machine (SVM) is a very powerful method to obtain a separating hypersurface with optimal generalization properties, via the maximum margin principle. The NLP problem it generates is usually faced through its dual, which is a simply constrained, convexQP problem. While the dual has been extensively studied, less is known about the primal SVM problem: we present a new SQP approach to the solution of the latter, which is shown to converge to the optimal solution. Some experiments will be presented and numerical aspects will be discussed.

Pattern classification deals with the identification of the class label for each object of two or more classes. Standard supervised approach uses only the features of objects with known class label. The idea behind the semisupervised learning is to make use also of information coming from unlabelled objects. Typically, the semisupervised approach requires solution of large scale problems. Our objective is to present a preprocessing of the dataset which, on the basis of the concept of separating set, reduces the number of unlabelled objects to be entered in the classification phase.

A number of effective supervised learning methodologies are available for the computation of the optimal classifier/regressor of a given data set, which are used in many application areas. However, the increasing amount of the data and of their dimensionality calls for software tools able to exploit the power of modern machines. We present a well parallelizable approach to the solution of the standard nonlinear Support Vector Machine (SVM) regression problem: it is based on a gradient-projection decomposition technique and it is very suitable for distributed-memory systems.

Many machine learning problems (e.g. training SVMs) have a mathematical programming (MP) formulation. An important advantage of SVMs is elegant non-linear modelling via kernel functions; however, a proper choice of kernel is crucial for accurate predictions. Multiple kernel learning (MKL) is an extension to SVMs that allows to optimize a linear combination of kernels during training. We review MKL, present its different MP formulations, and investigate their time complexity. Finally we discuss what is key for tuning mathematical programming to achieve the required computational efficiency.

A new look to the primal problem in SVM training

A two phase approach to semisupervised classification

Pattern classification deals with the identification of the class label for each object of two or more classes. Standard supervised approach uses only the features of objects with known class label. The idea behind the semisupervised learning is to make use also of information coming from unlabelled objects. Typically, the semisupervised approach requires solution of large scale problems. Our objective is to present a preprocessing of the dataset which, on the basis of the concept of separating set, reduces the number of unlabelled objects to be entered in the classification phase.

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In the P-Median problem, it is assumed that, once the facilities are opened, they may not fail. In practice some of the facilities may become unavailable due to several factors. In the Reliability P-Median Problem some of the facilities could not be operative in some periods. The objective is now to find facility locations that are both inexpensive and also reliable. We present two new hybrid meta-heuristics to solve the problem. We have carried out an extensive computational experiment to study the performance of the algorithms and compare its efficiency solving well known benchmark instances.

3 - A new capacitated arc routing problem type: formulation and solution approaches

Gokhan Kirlik, Department of Industrial Engineering, Eskisehir Osmangazi University, Kirmizitoprak Mh. Kinacici Sk. No:12/5 Demet Apt. 26020, Eskisehir, Turkey, gokhankirlik@gmail.com, Aydin Sipahioglu, Osman Parlaktuna, Ahmet Yazici

Multi-robot coverage problem is a challenging and heavily studied problem. Although it resembles Capacitated Arc Routing Problem (CARP) it has some differences from CARP. For example, a mobile robot consumes energy not only for traversing but also for moving and coverage. That situation requires defining two different arc demands for each arc. In constructing tour of each robot only one arc demand value should be used which makes the problem harder.

In this study, a new mathematical model and a genetic algorithm based solution approach is proposed to solve multi-robot coverage problem.

4 - A novel GRASP based tabu search with variable neighbourhoods for inventory distribution routing (idrp) problem

Mahmut Ali Gokce, Industrial Systems Engineering, Izmir University of Economics, Sakarya Cad. No: 155, Balicova/Izmir TURKEY, 35050, Izmir, Turkey, ali.gokce@ieu.edu.tr, Ozgur Akgun, Bertkay Beygo, Onur Coskunsefa

Inventory Distribution Routing Problem is a highly practical and theoretically challenging (NP-Hard) problem. We solve the single warehouse-heterogeneous fleet version, in its entirety, with a tabu search heuristic combined GRASP with a variable neighbourhood structure. We also present a constructive hyperheuristic modeling. We present the results of the tabu based heuristic, hyperheuristic and compare it to the optimal results of MILP for a computational study of generated instances.

2 - Technical efficiency based on cost gradient measure

Miki Tsutsui, Socio-economic Research Center, Central Research Institute of Electric Power Industry, 2-11-1 Iwadokita, Komae-shi, 2018511, Tokyo, Japan, miki@criepi.denken.or.jp, Kaoru Tone, Yuichiro Yoshida

We propose a new model named cost gradient measure (CGM), which enables us to measure more price-conscious technical efficiency. In the CGM model, projection to the efficiency frontier is defined by the cost gradient direction of each decision making unit (DMU), which is the normal to the cost plane and the steepest ascent direction of total input cost. This will be reasonable for company managers. Furthermore, we can derive CCR model from CGM formula, and it clearly implies CCR is under a strong restriction of proportionality. CGM can overcome shortcomings of traditional models.

3 - A method for finding strong defining hyperplanes of pps with variable returns to scale technology

Israfil Roshdi, Department of Mathematics, Science and Research Branch, Islamic Azad University, Tehran, Iran, Rajaei Avenue. Eslamabad alley. No 47. Marand,Iran, 5417733737, Marand, Azarbayjane-Sharghi, Iran, Islamic Republic Of, i.roshdi@gmail.com, Mostafa Davtalab Olyaie

It is well known that the optimal solutions of the envelopment formulation for extreme efficient units are often highly degenerate and, therefore, may have alternate optima for the multiplier form. Every optimal solution yields a hyperplane which is a supporting hyperplane at production possibility set(PPS). We will characterize the structure of strong defining hyperplanes of PPS with variable returns to scale technology, and computationally propose an effective algorithm for finding all of these hyperplanes.

4 - A simulation analysis to validate a new DEA model for controlling environmental impacts on efficiency measurements

Haiyan Zhu, Chemical Engineering and Applied Chemistry, University of Toronto, 200 College Street, Toronto, Ontario, Canada, MSS 3E5, Toronto, Ontario, haiyan.zhu@utoronto.ca, Joseph Paradi

Earlier, an effective and simple Culturally-Adjusted DEA model was developed for controlling the operating environment bias in production efficiency analysis when environmental conditions are partial causes of inefficiency and cannot be presented as inputs or outputs. We show here an effective simulation analysis to validate the CA-DEA model by comparing it to other DEA models used to control exogenous factors. Further tests are taken to model sensitivity to different degrees of environmental differences and different functional relationships between production and environmental variables.
Satisfiability and Graphs
Stream: Boolean Programming
Invited session
Chair: Ewald Speckenmeyer, Institut für Informatik, Universität zu Köln, Pohligstr. 1, 50969, Köln, Germany, esp@informatik.uni-koeln.de

1 - Feedback vertex set heuristics based on Markov chains
Mile Lemaic, Institut für Informatik, Universität zu Köln, Pohligstr. 1, 50969, Köln, lemaic@uni-koeln.de
A feedback vertex set (FVS) of a digraph G is a vertex set F such that G - F is acyclic. The minimum feedback vertex set problem asks for a FVS of G of minimum cardinality. While being one of the classic NP-hard problems [Karp72], it has important applications in many fields. The use of Markov chains for determining low cardinality FVSs has been demonstrated in [Speckenmeyer89]. In this talk, the original algorithm of Speckenmeyer is outlined and, additionally, some new heuristics are presented which also use Markov chains to determine small FVSs.

2 - Level graph formulas
Bert Randerath, Institut für Informatik, Universität zu Köln, Hochschuldozentur Diskrete Algorithmen, Pohligstr.1, 50969, Köln, Germany, randerath@informatik.uni-koeln.de
We study the crossing minimization problem on level graphs from a propositional logic perspective. This graph drawing problem turns out to be strongly related to MAXSAT. Although crossing minimization problem on level graphs can be transformed to PARTIAL-MAXSAT, we exploit an example demonstrating that our problem cannot be encoded as MAXSAT subproblem. Apart from this we modify the local search underlying neighbourhood relation accordingly such that we can apply well-known MAXSAT local search heuristics for our problem. (Joint work with E. Speckenmeyer, M. Gärtner, M. Lemaic and S. Porschen.)

3 - Deterministic local search for the k-sat problem: an algorithm and some improvements
Dominik Scherer, Institut fuer Theoretische Informatik, CAB G 39, 1, Universitaetsstrasse 6, 8092, Zurich, dominik.scherer@inf.ethz.ch
Currently the fastest deterministic algorithms for 3-SAT use the idea of local search. This involves a combination of covering codes and a simple recursive procedure. We improve the latter to obtain the currently best worst-case running time.

Operations of Closed Loop Supply Chains (II)
Stream: OR and Environmental Management
Invited session
Chair: Erwin van der Laan, RSM Erasmus University, P.O.Box 1738, 3000DR, Rotterdam, Netherlands, elaan@rsm.nl

1 - Robust product line design with pricing
Niels Becker, Department of Economics, Ruhr-University Bochum, Lehrstuhl Prof. Dr. B. Werners, GC 1/58, 44780, Bochum, Germany, niels.becker@rub.de
For OEMs, product and component recycling strategies are advantageous. Therefore the integration of recycling processes into production planning is regarded. Within the contribution a master production and recycling model is developed regarding uncertainties of product return and demand. The model is applied on the case of a manufacturer executing the original production process as well as product and component recycling processes simultaneously.
Product line design models use customers’ willingness to pay (wtp) to optimize product lines. But often customers’ wtp is uncertain even when determined with Conjoint Analysis. To handle this uncertainty adequately, we introduce a robustness parameter into a deterministic model. By modifying this parameter optimal solutions are determined which are efficient concerning the criteria expected profit and variance. Our results demonstrate that robust product line design outperforms even additional information gathering.

2 - Decision theory and fuzzy approaches for customer valuation in revenue management

Andreas Hilbert, Fakultät Wirtschaftswissenschaften, Technische Universität Dresden, 01062, Dresden, Germany, andreas.hilbert@tu-dresden.de, Tobias von Martens

The incorporation of customer value into revenue management is naturally associated with uncertainties that may result in inappropriate control decisions. Consequently, in order to facilitate efficient capacity control decisions despite uncertainties, this paper examines the managerial activities of revenue management regarding uncertainties and applies an extended, fuzzy-based decision model to the capacity control problem. The methodology developed in this article supports customer-value-based revenue management decisions and contributes to the competitive capabilities of service providers.

3 - Estimating unconstrained demand rate functions using customer-choice sets

Alwin Haensel, Department of Mathematics, VU University Amsterdam, De Boelelaan 1081A, 1081 HV, Amsterdam, ahaensel@few.vu.nl

A good demand forecast is at the heart of every Revenue Management model. Yet most demand models focus on product demand and do not incorporate customer choice behavior under offered alternatives. We are using the ideas of customer choice sets to model the choice behavior and develop a demand rate estimation procedure based on the maximum likelihood and the expected maximization method for incomplete data, i.e. in the case that choice sets are overlapping or no-purchase outcomes are not observable due to the unavailability of price classes for bookings.

4 - Single-leg airline revenue management with overbooking

Nurses Aydin, Industrial Engineering, Sabanci University, Orhanli, Tuzla, 34956, Istanbul, Turkey, nursesaydin@su.sabanciuniv.edu, S. Ilker Birbil, J.b.g. Frenk, Nilay Noyan

Airline Revenue Management (ARM) problem focuses on finding a seat allocation policy, which results in the maximum profit. Overbooking has been receiving significant attention in ARM. In this study, we propose new models for static and dynamic single-leg problems that consider overbooking and no-shows. In the static case we introduce models that give upper and lower bounds for the optimal expected profit. In dynamic case we propose a dynamic programming model based on two streams for booking and cancellation processes. We also present numerical results to show the effectiveness of our models.

TD-24

Extremal Problems and Applications I

Stream: Nonlinear Programming

Invited session

Chair: Adilson Elias Xavier, Graduate School of Systems Engineering and Computer Sciences, Federal University of Rio de Janeiro, P.O. Box 68511, Ilha do Fundão - Centro Tecnologia - H319, 21941-972, Rio de Janeiro, RJ, Brazil, adilson@cos.ufrj.br

1 - Application of nonlinear optimization technique to energy saving problems

Mikhail Mikhailevich, Systems Analysis, Ukrainian University of Finance and International Trade, Gonchar str.,65-A,apt.20, 01054, Kiev-54, Ukraine, mmikhailevich@ukr.net, Ludmilla Koshliai

We consider two types of optimization models for decision support concerning technological changes for energy saving. Models of the first type determine the main directions of technological changes. They have continuous variables; the subgradient methods have been applied for calculations. Models of the second type are combinatorial; they support the choice of projects for technological changes. The multi-extremum nature of problems can be allowed for by running the calculations from different starting points. This approach is realized at the multiprocessor computer.

2 - A new predictor-corrector method for optimal power flow

Roy Wilhelm Probst, DMA - IMECC, UNICAMP, Caixa Postal 6065, 13083-859, Campinas, SP, Brazil, roy@ime.unicamp.br, Aurelio Oliveira

A predictor-corrector interior point method is developed to the AC active and reactive optimal power flow problem. Voltage rectangular coordinates is adopted instead of polar ones, once it allows nonlinear corrections for the primal and dual feasibility conditions and not only for the complementary ones as in the traditional nonlinear programming method. Computational experiments for IEEE systems problems and a real Brazilian system are presented showing the advantages of the proposed approach.

3 - The extended hyperbolic smoothing clustering method: computational results

Adilson Elias Xavier, Systems Engineering and Computer Sciences Dept., Federal University of Rio de Janeiro, CT Bloco H Sala H319, Ilha do Fundao, 21941-972, Rio de Janeiro, RJ, adilson.xavier@gmail.com, Vinicius Layter Xavier

The minimum sum-of-squares clustering problem is considered. It has a non-differentiable characteristic. To overcome these difficulties, the proposed resolution method, called Hyperbolic Smoothing, adopts a smoothing strategy using a special completely differentiable function. This paper presents an extended method based upon the partition of the set of observations in two non overlapping parts. This last approach engenders a drastic simplification of the computational tasks. A broad set of computational experiments shows the good performance of the new method.
The Shapley value

Stream: Cooperative Game Theory
Invited session
Chair: Yukihiko Funaki, School of Political Science and Economics, Waseda University, Nishi-Waseda 1-6-1, Shinjuku-ku, 1698050, Tokyo, Japan, funaki@waseda.jp

1 - Population normalized balanced contributions property and the per-capita Shapley value
Takumi Kongo, Graduate School of Economics, Waseda University, Nishi-waseda 1-6-1, Shinjuku-ku, Tokyo, 1698050, Tokyo, kongo_takumi@toki.waseda.jp


2 - Axiomatization and implementation of discounted Shapley values
Rene van den Brink, Free University of Amsterdam, 1081HV, Amsterdam, Netherlands, jrbrink@feweb.vu.nl, Yukihiko Funaki

We generalize the null player property (satisfied by the Shapley value) and nullifying player property (satisfied by the equal division solution) to the delta-reducing player property, stating that a delta-reducing player (being a player i such that any coalition containing i earns a fraction delta in [0,1] of the worth of that coalition without player i) earns a zero payoff. We axiomatize the delta-discounted Shapley value using the corresponding delta-reducing player property, and provide a strategic implementation where delta is a discount factor applied if the proposal is rejected.

3 - A coalition formation value for games in partition function form
Yukihiko Funaki, School of Political Science and Economics, Waseda University, Nishi-Waseda 1-6-1, Shinjuku-ku, 1698050, Tokyo, Japan, funaki@waseda.jp, Michel Grabisch

If forming the grand coalition generates the largest total surplus, a central question is how to allocate its worth to each player, taking into account the whole process of coalition formation. We propose three concepts of scenario-value, process-value and a coalition formation value, which represent the average contribution of players in a scenario, a particular sequence of coalitions within a given coalition formation process, in a process, a sequence of partitions of the society, and all processes, respectively. We give an economic application and an axiomatization.

Network Flow Problems

Stream: Discrete Optimization
Contributed session
Chair: Ankit Khandelwal, Consumer Banking Risk Analytics, Standard Chartered Bank, 51 Bras Basah Road #08-04, Plaza by the Park, 189554, Singapore, Singapore, ankit.khandelwal@gmail.com

1 - Fast estimation of expected maximum flows through reliable networks
Megha Sharma, Production & Quantitative Methods, Indian Institute of Management Ahmedabad, D-230 IIM Ahmedabad, Vastrapur, 380015, Ahmedabad, Gujarat, India, meghas@iimahd.ernet.in, Diptesh Ghosh

We present a fast evaluation strategy for estimating expected maximum flows through reliable networks. Our strategy saves on computational effort by using the residual network obtained from a network state to evaluate other states. Computational experiments on randomly generated networks with up to 125 nodes and 3500 arcs show that our strategy can reduce computation times by up to 50% on average with a standard deviation of 2%. In terms of the number of Ford Fulkerson iterations the reduction is up to 56% on average with a standard deviation of 3%.

2 - Flow constrained minimum cost flow problem
Sonia Arora Singh, Decision Sciences Group, Indian Institute of Management, Prabandhi Nagar, Off Sitapur Road, 226013, Lucknow, India, sonia.arora.singh@gmail.com

The paper studies variants of the Minimum Cost Flow Problem (MCFP) subject to additional flow constraints which is the generalization of transportation problems with restrictions on total flow value. Based on the relationship between the desired flow value and the sum of capacities of source(s) and sink(s) different set of problems are mathematically formulated, irrespective of whether or not the sum of node capacities is zero. In each case an equivalent standard MCFP is formulated whose optimal solution provides the optimal solution to the original flow constrained problem.

3 - Labeling algorithms for the earliest and latest time-varying maximum flow problems
Dan Sha, Business Information Management School, Shanghai Institute of Foreign Trade, Business Information Management School, Shanghai Institute of Foreign Trade, Shanghai, China, 201620, Shanghai, danielsha@hotmail.com, Wenhua Yu

We consider time-varying network $G(N,A,b,l)$. Both $b(i,j,t)$ and $l(i,j,t)$ are functions of the departure time $t$ at the beginning node of arc $(i,j)$, where $t=0,1,\ldots,T$, and $T>0$ is a given number. The earliest (or the latest) maximum flow is the maximum flow could be sent from the source node to the sink node in $G(N,A,b,l)$ within $T$ with the earliest (or the latest) arrival time. We assume that waiting at any node is prohibited except the source node. The problem is NP-complete. Labeling algorithms are proposed for solving problems in $O(mnT^3)$ time, where $m=|A|$ and $n=|N|$.

4 - Flow enhancement with cost saving in a min cost network flow problem
Ankit Khandelwal, Consumer Banking Risk Analytics, Standard Chartered Bank, 51 Bras Basah Road #08-04,
Plaza by the Park, 189554, Singapore, Singapore, ankit.khandelwal@gmail.com, Sonia Arora Singh

This paper discusses flow enhancement to the maximum possible extent in a minimum cost network flow problem (MCFP) along with a saving in shipment cost. An equivalent standard MCFP is formulated whose optimal solution provides the solution to the flow enhancement problem.

Mixed model assembly line literature involves two problems: balancing and model sequencing. The general tendency in current studies is to deal with these problems in different time frames. However, in today's competitive market the mixed model assembly line balancing problem has been turned into an operational problem. In this study, we suggest a mathematical model which considers both of these problems within the same formulation along with task sequencing. Moreover, we present the results of experimenting this model on various size problems and discuss some future research directions.

4 - Profit oriented disassembly line balancing with stochastic task times

F. Tévhide Altekin, Faculty of Management, Sabancı University, Orhanlı, Tuzla, 34956, Istanbul, Turkey, altekin@sabanciuniv.edu

The profit oriented disassembly line balancing problem seeks a feasible assignment of selected disassembly tasks to stations such that the precedence relations among the tasks are satisfied and the profit is maximized. In this study, we extend the profit oriented disassembly line balancing problem for designing paced disassembly lines involving tasks that exhibit significant time variations. The effects of incomplete tasks are explicitly considered and the expected completion costs are defined. Computational analysis is conducted and results are compared to the deterministic method.
Our work is motivated by the situation of a retailer planning a price reduction. For this purpose estimating a price-response-function is important, relating sales to the prices of own and competitive brands. Unobserved heterogeneity is taken into account by allowing the response function to vary between different stores. In addition, price effects are estimated flexibly to account for nonlinearities in sales response. Bayesian inference based on Markov Chain Monte Carlo (MCMC) techniques to estimate price response is presented.

3 - Modeling time-dependent effects in consumer choice behavior

Winfried Steiner, Marketing, Clausthal University of Technology, Institute of Management and Economics, Julius-Albert-Str. 2, 38678 Clausthal-Zellerfeld, 38678, Clausthal-Zellerfeld, Germany, winfried.steiner@tu-clausthal.de, Thomas Kneib, Bernhard Baun gartner

We employ flexible multinomial logit models to analyze dynamics in brand choice behavior. Both time-varying preferences and time-varying effects of covariates are modeled based on penalised splines, a flexible yet parsimonious nonparametric smoothing technique. The estimation procedure is fully data-driven, determining the flexible function estimates as well as the corresponding degree of smoothness in a unified approach. Preliminary results suggest that the model considering time-variable parameters outperforms the exible function estimates as well as the corresponding degree of smoothness in a unified approach. Preliminary results suggest that the model considering time-variable parameters outperforms the

In the EU Emissions Trading Scheme CO2 emissions trade allowances were introduced as a new tradable asset, with the aim of reducing CO2 emissions. Market participants have to manage the risk of fluctuating EUA prices and require appropriate tools to hedge and diversify.

The issue is relevant for energy producer companies, who need, for a given output, a specified number of emission certificates that are consumed in the production process. In this paper we introduce the cost of CO2 emission certificates in the optimal policy of an energy conventional/renewable (non monopolist) producer.

3 - A new index for electricity spot markets

Silvana Stefani, Metodi Quantitativi per le Scienze Economiche e Aziendali, Università Milano Bicocca, Piazza Ateneo Nuovo 1 U7-4023, I-20126, Milano, Italy, silvana.stefani@unimib.it, Paolo Falbo

Different daily indexes are now published to describe electricity spot markets. However, the choice of the mathematical formulation is not neutral, since can have significant effects on derivative pricing and hedging performance.

We propose a new index (FAST Index) that overcomes theoretically and practically all the mentioned drawbacks. We simulate the hedging strategy on an Asian option written on a reference Index. The results, applied to OMEL and EEX markets, are clear enough to suggest that the decision to adopt an index to represent properly a market must be taken carefully.

3 TD-30

Tuesday 12:55-14:15

GSI - S 26

Energy, Oil and Gas 1

Stream: Engineering Optimization

Invited session

Chair: Steffen Rebbennack, Industrial and Systems Engineering, University of Florida, 303 Weil Hall, P.O. Box 116595, 32611, Gainesville, Florida, United States. steffen@ufl.edu

Chair: Przemysaw Kacprzak, Institute of Control & Computation Engineering, Warsaw University of Technology, Swiatowida 63/16, 03-144, Warsaw, Poland. P.Kacprzak@elka.pw.edu.pl

Chair: Niko Iliadis, PSR / EnerCoRD, Plastira street 4, Nea Smyrni, 171 21, Athens, Greece, nikolaos.iliadis@a3.ep.fch

1 - Oil production optimization - solved by column generation

Vidar Gunnerud, Thomas Angellsgate 5, 7011, Trondheim, vidarg@ntnu.no, Bjorn Nygreen, Ken McKinnon, Bjarne Foss

Upstream petroleum production systems are usually quite complex consisting of many wells, pipelines and processing units. The Troll West oil field infrastructure on the Norwegian continental shelf has a structure which makes it possible to decompose its short term production optimization model. The presentation will start by discussing appropriate well models and pressure drop models for multiphase pipe flow. Further, the focus will be set on how the model can be decomposed into sub-problems for collections of wells. Finally, we present near-optimal results by column generation.

2 - Profit maximization in the liquefied natural gas value chain

Kristin Tolstad Uggset, Applied economics and operations research, SINTEF Technology and society,
In this work we consider feature selection for two-class linear models, a challenging task arising in several real-world applications. Feature selection involves two competing objectives: the prediction capability (to be maximized) of the linear classifier, the number of features (to be minimized) employed by the classifier. In order to take into account both the objectives, we propose a feature selection strategy that combines SVMs with a concave optimization approach. We report results of an extensive computational experience showing the efficiency of the proposed methodology.

3 - DC programming and spherical separation

Antonio Fuduli, Department of Mathematics, Universita' della Calabria, Via P. Bucci, CUBO 31B, 87036, Rende, Italy, antonio.fuduli@unical.it, Annabella Astorino, Manlio Gaudioso

We present two different approaches for spherical separation of two sets. Both the methods are based on minimizing two respective non-convex nondifferentiable error functions, which are expressible as Difference of two Convex (DC) functions. A DC-Algorithm (DCA) has been adopted and numerical results on classical binary datasets have been obtained. We compare our results with those obtained by running the fixed-center spherical classification method.

4 - Probabilistic structured predictors

Shankar Vembu, Knowledge Discovery, Fraunhofer IAIS, Schloss Biringhoven, 53754, Sankt Augustin, shankar.vembu@iais.fraunhofer.de, Thomas Gaertner, Mario Boley

We consider MAP estimators for structured output prediction with exponential family models. In particular we focus on the case that efficient algorithms for uniform sampling from the output space exist. We show that under this assumption (i) exact computation of the partition function remains a hard problem and (ii) the partition function and the gradient of the log partition function can be approximated efficiently. Our main result is an approximation scheme for the partition function based on Markov chain Monte Carlo theory. We also describe application settings in machine learning.

TD-31

Tuesday 12:55-14:15

Training Algorithm for Support Vector Machines

Stream: Optimization and Data Mining

Invited session

Chair: Shankar Vembu, Knowledge Discovery, Fraunhofer IAIS, Schloss Biringhoven, 53754, Sankt Augustin, shankar.vembu@iais.fraunhofer.de

1 - Second-order smo for svm online and active learning

Christian Igel, Institut für Neuroinformatik, Ruhr-Universität Bochum, Ruhr-Universität Bochum, 44780, Bochum, Germany, igel@neuroinformatik.rub.de, Tobias Glas machers

The LASVM by Bordes et al. iteratively approximates the SVM solution using sequential minimal optimization (SMO). It allows for online and active learning. In each SMO step LASVM uses the most violating pair heuristic for choosing a pairs of variables for optimization. We propose to replace this strategy by a second order method, which greedily maximizes the progress in the dual in each single step. Our algorithm learns faster and finds sparser hypotheses, because even a few unfavorable decisions by the first-order heuristic may impair the course of optimization.

2 - Feature selection combining linear support vector machines and concave optimization

Francesco Rinaldi, Dipartimento Informatica e Sistemistica, Sapienza, via Ariosto, 25 Roma, 00185, Rome, Italy, francesco.rinaldi@iasi.cnr.it

TD-32

Tuesday 12:55-14:15

DMKD methods and techniques

Stream: Data Mining and Knowledge Discovery

Invited session

Chair: Nikos Pelekis, Department of Informatics, University of Piraeus, 80 Karaoli & Dimitriou St, 18534, Piraeus, npelekis@unipi.gr

1 - Inductive generation of foreign exchange forecast models

Roman Sologub, Innovations and High Technology, Moscow Institute of Physics and Technology, 508, 86, Altufievskoe sh., Moscow, 127349, Moscow, alucardische@gmail.com

An algorithm of the search for a parametric regression model in a model set is described. The model set is a set of superpositions of smooth functions. The model parameters density estimations are used for the search. To illustrate the approach, the problem of a short-term foreign exchange price forecast is considered. The task is to generate models, which make next-minute price forecast. Exchange prices for different currency pairs and some of the indexes were used as data sets. The generated models show impacts on the market. The project is supported by RFBR, 07-07-00181.
2 - Interesting patterns using goal programming

Yasir Intiaz Khan, computer science, university of central punjab Lahore, 31 main gulberg Lahore, 54000, Lahore, Pakistan, khialian@hotmail.com, Asim Raza, Syed Hasnain Haider Gilani

Data mining leads to the discovery of large number of patterns, all of these patterns can not be of interest to user. Therefore mining of interesting patterns from the set of mined patterns is an issue. In this paper we proposed that using goal programming we can find interesting patterns according to the user requirement at particular time. In order to control the priority of interesting patterns we can attach the deviational variables.

■ TD-33
Tuesday 12:55-14:15
GSI - S 7

Integer Programming
Stream: Linear Optimization
Contributed session
Chair: Hilary Paul Williams, Operational Research, London School of Economics, Houghton Street, WC2A2AE, LONDON, UK, h.p.williams@lse.ac.uk

1 - The chvatal dual of a pure integer programme
Hilary Paul Williams, Operational Research, London School of Economics, Houghton Street, WC2A2AE, LONDON, UK, h.p.williams@lse.ac.uk

We give a graphical way of representing Chvatal functions. Also we give some limited ways in which they can be simplified by removing unnecessary rounding operations. A method of calculating Chvatal functions over a cone will be given. Finally it will be shown that when the rounding operations are removed from a Chvatal function it corresponds to either an extreme or an interior point of the dual LP polytope.

2 - Solving lagrangian relaxations on networks by approximate subgradient methods
Eugenio Mijangos, Applied Mathematics, Statistics and Operations Research, University of the Basque Country, P.O. Box 644 – Dept. Matematica Aplicada y E.I.O. (UPV/EHU), 48080, Bilbao, Spain, eugenio.mijangos@ehu.es

The efficiency of the network flow techniques can be exploited in the solution of nonlinearly constrained network flow problems by means of approximate subgradient methods (ASM). The idea is to solve the dual problem by using ASM, where the dual function is estimated by minimizing approximately a Lagrangian function that relaxes the side constraints and is subject only to the network constraints. Some convergence results for ASM are showed. To evaluate the efficiency of these methods their performance has been computationally compared with other well-known codes.

3 - A new pivoting procedure for strengthening gomory mixed-integer cuts
Franz Wesselmann, Decision Support & OR Lab, University of Paderborn, Warburger Str. 100, 33098, Paderborn, Germany, wesselmann@dsor.de, Achim Koberstein, Uwe Suhl

Gomory Mixed-Integer (GMI) cuts play a central role in solving hard mixed-integer programming problems. Different approaches to strengthen these cuts have been proposed. We present a heuristic algorithm which tries to improve the performance of GMI cuts by performing a sequence of pivots on the simplex tableau. Our approach is related to reduce-and-split cuts. We give a detailed description of the algorithm and its implementation. Finally, we report on computational results with our approach and analyze its performance.

■ TD-34
Tuesday 12:55-14:15
GSI - S 8

Business Intelligence for Risk Management in Consumer Credit
Stream: Applications in Business Intelligence and Knowledge Discovery
Invited session
Chair: Lyn Thomas, University of Southampton, United Kingdom, l.thomas@soton.ac.uk

1 - Collection comparison — differences between in-house collection and agency.
Anna Matuszyk, Economic Insurance Cathedral, Warsaw School of Economics, Al. Niepodleglosci 164, 02-554, Warsaw, Poland, amatuszyk@matuszyk.com, Lyn Thomas

In this analysis data on the collection results from both an in house collections group and an agency were examined. This allowed a comparison of the the collections processes and the type of information available. The corresponding LGD distributions in each case could be considered as mixture of distributions but the relative importance of the distributions is different in the two cases. Regression and logistic regression was used to predict the LGD values for the different distribution types in terms of characteristics of the loan, the debt and the borrowers performance before default.

2 - Practical experiences from credit scoring projects for Chilean financial organizations for micro-entrepreneurs
Sebastian Maldonado, Department of Industrial Engineering, University of Chile, Santiago, Chile, semaldon@ing.uchile.cl, Cristian Bravo, Richard Weber

All financial organizations that offer loans to their customers have the problem to determine if the loaned money will be returned. Credit scoring systems have been successfully applied to determine the probability that a certain customer will fail in paying back the received credit.

We have developed credit scoring systems for several Chilean financial organizations for micro-entrepreneurs mapping the KDD process to their special needs. This paper presents our experiences from these projects and explains in detail how we solved the problems in each step of the KDD process.

3 - Model follow-up in credit scoring projects
Cristian Bravo, Department of Industrial Engineering, University of Chile, Republica 701, Santiago, 8370439, Santiago, Chile, cibravo@ing.uchile.cl, Sebastian Maldonado, Richard Weber
Most KDD projects in real — life applications offer only static solutions that over the time lose their capacity to explain the phenomena for which they were constructed. We present a framework for model updating and model follow-up which allows the user to keep a strict control of the model’s evolution, its variables, and the relevant changes in the population that can occur since the model was built. In particular we propose to apply statistical techniques in order to determine changes in feature weights and structural changes in the respective universe.

4 - Modelling credit risk in portfolios of consumer loans: how to uncrunch credit

**Lyn Thomas**, University of Southampton, United Kingdom, l.thomas@soton.ac.uk, **Madhur Malik**

The failure of the credit rating agencies’ models to correctly price consumer based securitized product like RBMS shows the need to improve the modelling of the credit risk of portfolios of consumer loans. This paper describes three ways one can develop dynamic models which can do this using behavioural scores. One is a Markov chain approach akin to ‘mark to market reduced form modelling’ or assessing production costs and support emissions-related incentives. For traders and CO2 emitting companies it becomes increasingly important to have a valid CO2 spot price model in order to value derivatives or assess production costs and support emissions-related investment decisions. Seifert et al. (2008) have developed a stochastic equilibrium model depending on expected cumulative emissions and maturity for a single trading period. We extend this model, according to the current setting of the EU ETS, to a multi-period model accounting for inter-period banking and later delivery of lacking certificates and show implications on the certificate spot prices.

1 - Dynamic behavior of CO2 spot prices

**Steffen Hitzenmann**, University of Karlsruhe (TH), Gaistalweg 7, 76199, Karlsruhe, steffen.hitzenmann@fbv.uni-karlsruhe.de

Chair: **Martin Rainer**, ENAMEC, Glockengasse 15, D-97070 Würzburg, 97070, Würzburg, Germany, martin.rainer@enamec.de

Chair: **Steffen Hitzenmann**, University of Karlsruhe (TH), Gaistalweg 7, 76199, Karlsruhe, steffen.hitzenmann@fbv.uni-karlsruhe.de, **Marliese Uhrig-Homburg**

For traders and CO2 emitting companies it becomes increasingly important to have a valid CO2 spot price model in order to value derivatives or assess production costs and support emissions-related investment decisions. Seifert et al. (2008) have developed a stochastic equilibrium model depending on expected cumulative emissions and maturity for a single trading period. We extend this model, according to the current setting of the EU ETS, to a multi-period model accounting for inter-period banking and later delivery of lacking certificates and show implications on the certificate spot prices.

2 - The randomized multicriteria spatial price network problem

**Laura Scrimali**, DMI, Università di Catania, Viale Andrea Doria 6, 95125, Catania, Italy, scrimali@dmi.unict.it, **Fabio Raciti**

We consider the multicriteria spatial price network equilibrium model in which consumers are allowed to weight both the transportation cost and the transportation time associated with the shipment of a given commodity. In particular, we assume that weights are not deterministic but subject to random fluctuations. Therefore, we formulate the problem as a random variational inequality, and compute mean values and variances of solutions for suitable probability distributions.

3 - Equilibria in markets with non convexities

**Gabriella Muratore**, OPAC, Technische Universität Eindhoven, Den Dolech 2, P.O. Box 513 Pav E11, 5600 MB, Eindhoven, Netherlands, gabriellamuratore@yahoo.com

In this paper we address the issue of finding efficient partial equilibria in markets with non-convexities. This is a problem that has intrigued generation of economists. Beside its theoretical importance this issue is fundamental in energy markets which do not give the right price signals and incentives to maintain existing and invest in new generating capacity. The theoretical results can be used to find an ex-post optimal policy in energy markets, able to restore incentives.

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**TD-35**

Tuesday 12:55-14:15

GSI - S 9

Equilibrium Prices

Stream: Value and Risk in Incomplete Markets

*Invited session*

Chair: **Steffen Hitzenmann**, University of Karlsruhe (TH), Gaistalweg 7, 76199, Karlsruhe, steffen.hitzenmann@fbv.uni-karlsruhe.de

Chair: **Martin Rainer**, ENAMEC, Glockengasse 15, D-97070 Würzburg, 97070, Würzburg, Germany, martin.rainer@enamec.de

1 - Dynamic behavior of CO2 spot prices

**Steffen Hitzenmann**, University of Karlsruhe (TH), Gaistalweg 7, 76199, Karlsruhe, steffen.hitzenmann@fbv.uni-karlsruhe.de, **Marliese Uhrig-Homburg**

2 - The randomized multicriteria spatial price network problem

**Laura Scrimali**, DMI, Università di Catania, Viale Andrea Doria 6, 95125, Catania, Italy, scrimali@dmi.unict.it, **Fabio Raciti**

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**TD-36**

Tuesday 12:55-14:15

GSI - S 11

Stochastic Modelling 2

Stream: Stochastic Modelling

*Contributed session*

Chair: **Cherkerz Aghayeva**, Statistics, Yasar University, Selcuk Yasar Campus Universite Caddesi, N 35-37, Bornova, 232, Izmir, Turkey, cher.aghayeva@rambler.ru

1 - Risk-sensitive average cost optimality in Markov decision chains

**Karel Sladky**, Department of Econometrics, Institute of Information Theory and Automation Academ of Sciences of the Czech Republic, Pod Vodarenskou vezi 4, 18208, Prague 8, Czech Republic, sladky@utia.cas.cz

Employing properties of a collection of nonnegative matrices constructed from Markov reward (cost) chains fulfilling "product property" common in Markov programming, we shall characterize policies yielding minimal risk-sensitive costs in discrete-time Markov decision chains, i.e. if the stream of one-stage costs is evaluated by an exponential utility function. Conditions guaranteeing independence of optimal values on starting state will be given. Policy and value iteration algorithms for finding optimal policies, along with bounds on current and optimal values, will be discussed.

2 - Simulation of rare and extreme events using nonlinear stochastic differential equations

**Bronislav Kaulakys**, Institute of Theoretical Physics and Astronomy of Vilnius University, A. Gostauto 12, LT-01108, Vilnius, Lithuania, kaulakys@ipa.lt


3 - Using service life in modeling human mortality

**Otilija Sedlak**, Quantitative methods for economics, Faculty of Economics Subotica, Segedinski put 9-11., 24000, Subotica, Vojvodina, zotisz@tipnet.rs, **Dragan Stojic**
We propose a model for human mortality based on service life bathtub-shaped hazard rate. We let the parameters modeling longevity be fuzzy numbers capturing uncertainty. We also look into pricing rules for life annuities and insurance by letting the interest rate be a fuzzy random variable as well. We use both triangular and trapezoidal fuzzy numbers and compare the level of reserves needed to cover benefits when the number of claims follows both Poisson process as well as Poisson process with a drift.

4 - The necessary condition of optimality for variable structure control systems with delay

M. Sonmez, Statistics, Yasar University, Selcuk Yasar Kampus Univesite Caddesi, N 35-37, Bornova, 232, Izmir, Turkey, m.sonmez@lboro.ac.uk

Many problems in theories of the automatic control, in self-oscillating system and etc. are described by stochastic differential equations with delay. Earlier were considered problems of stochastic optimal control with variable structure and problems of stochastic optimal control with delay. The present work is devoted to the problem of stochastic optimal control for variable structure systems with delay on phase at restriction on right endpoint constrain. Our objective is to obtain a necessary condition for optimality, when diffusion coefficient does not contain the control variable.

**TD-37**

Tuesday 12:55-14:15  
GS I - S 12  
Multi-Criteria Decision Aids - 2

Stream: Decision Analysis  
**Contributed session**

Chair: Mahmut Sonmez, The Business School, Loughborough University, Ashby Road, LE11 3TU, Loughborough, Leicestershire, United Kingdom, m.sonnmez@lboro.ac.uk

1 - Building a binary outranking relation in uncertain, imprecise and multi-experts contexts: the application of evidence theory

Boujelbene Mohamed Aymen, GIAD, Faculté des sciences économiques et de gestion de Sfax, Route Ain km 5, Koucha Ben Amer, Chez Boujelbene Ridha (Quincaillerie), 3042, Sfax, Tunisia, Tunisia, ayman.boujelben@yahoo.fr, Yves De Smet, Frikha Ahmed, Habib Chabchoub

We consider multicriteria decision problems where the actions are evaluated on a set of ordinal criteria. The evaluation of each alternative with respect to each criterion may be uncertain and/or imprecise and is provided by one or several experts. We model this evaluation as a basic belief assignment (BBA). In order to compare the different pairs of alternatives according to each criterion, the concept of first belief dominance is proposed. Additionally, criteria weights are also expressed by means of a BBA. A model inspired by ELECTRE I is developed and illustrated by a pedagogical example.

2 - Purchasing professional services: which decision criteria?

Mahmut Sonmez, The Business School, Loughborough University, Ashby Road, LE11 3TU, Loughborough, Leicestershire, United Kingdom, m.sonnmez@lboro.ac.uk

This paper reports the findings of a global survey on decision criteria used and the importance attached to these criteria when purchasing professional services for skills training in sales negotiations. This research was based on 24 face-to-face and telephone interviews with global learning and development managers plus 309 usable responses to an online survey. The respondents were asked to evaluate the importance of six 'high level' criteria and 37 sub-criteria when purchasing professional services. Descriptive statistics and exploratory factor analysis were used to analyse the survey data.

**TD-38**

Tuesday 12:55-14:15  
GS I - S 13  
Optimization and Generalized Nash Equilibria

Stream: Variational Inequalities and Bi-Level Problems  
**Invited session**

Chair: Andreas Fischer, Department of Mathematics, Technische Universität Dresden, Institute of Mathematics, 01062, Dresden, Germany, Andreas.Fischer@tu-dresden.de

1 - Relaxation methods for generalized nash equilibrium problems

Christian Kanzow, University of Wuerzburg, Institute of Mathematics, Am Hubland, 97074, Wuerzburg, kanzow@mathematik.uni-wuerzburg.de, Anna von Heusinger

The generalized Nash equilibrium problem (GNEP) is an extension of the standard Nash game where also the strategy spaces depend on the rivals’ strategies. A popular method for the solution of GNEPs is the relaxation method which is globally convergent under a set of fairly mild conditions. Here we present a modified relaxation method for the solution of GNEPs. The convergence analysis avoids some of the technical conditions for the original relaxation method. Numerical experiments indicate that the modified relaxation method performs quite well on a number of examples.

2 - Newton’s method for the computation of a normalized nash equilibrium through fixed point formulation

Anna von Heusinger, Institute of Mathematics, University of Würzburg, Am Hubland, 97074, Würzburg, Germany, heusinger@mathematik.uni-wuerzburg.de, Christian Kanzow, Masao Fukushima

We consider the generalized Nash equilibrium problem (GNEP), which differs from the standard Nash equilibrium problem in that not only the players’ cost functions depend on the rivals’ decision variables, but also their strategy spaces. The GNEP occurs, among others, in models for energy markets, emissions trading, and communication networks design. Here we present a fixed point formulation of the so-called normalized Nash equilibriums, a subset of the generalized Nash equilibriums. We apply Newton’s method and prove local superlinear convergence under fairly mild conditions.

3 - A new line search inexact restoration approach for nonlinear programming

Andreas Fischer, Department of Mathematics, Technische Universität Dresden, Institute of Mathematics, 01062, Dresden, Germany, Andreas.Fischer@tu-dresden.de, Ana Friedlander
A new inexact restoration approach is presented. It simplifies the restoration principle by Martinez and Pilotta. After the restoration step the new iterate is obtained by means of a single line search on an approximate tangent direction. All accumulation points generated by the algorithm are proved to satisfy a necessary optimality condition. In addition, the regularity condition that is usually needed in the restoration step is weakened. To some extent this also enables the application of the new approach to programs with complementarity constraints.

The assessment of the stability of the banking sectors is important for regulators, depositors and investors. In the present study, we use the risk ratings of the Economist Intelligent Unit, and we classify the banking sectors in three stability groups (low, medium, high). Classification models are developed using two MCDA techniques based on a sample of around 100 banking sectors. The set of criteria consists of indicators of the macroeconomic and institutional environment, as well as basic characteristics of the banking sector.
4 - Discrete models of social structures

Petr Bulava, Dept. of Mathematics, University of Ostrava, 30.dubna street, 22, 70201, Ostrava, Czech Republic, peta.bulava@email.cz

My paper deals with models of social structures which are studied using the discrete simulation methodology. Such models are typically characterized by intelligent elements representing human entities which may constitute some groups and these groups or entities come into interaction. Living rules of entities are rather simple but they often make decisions in these models which depend on many miscellaneous factors. Behavior of such models is non-trivial. We will discuss several models, for example disease spread models which offer more possibilities than classical Kermack-McKendrick approach.

4 - The two- and three-stage assembly flowshop problem

Uttarayan Bagchi, Information, Risk, & Operations Management, The University of Texas at Austin, McCombs School of Business, 1 University Station, B6500, 78712-0212, Austin, TX, bagchiu@gmail.com

We consider the assembly flowshop problem with multiple parallel, non-identical machines in the first, say fabrication stage, one machine in the second, say assembly stage, and one machine in the third, say testing stage. For the two-stage (fabrication and assembly) problem, we extend the exact results concerning permutation schedules and heuristic performance. For the three-stage problem, we present new results similar to those for the two-stage problem. Finally, we consider the non-skipping version of the three-stage problem.
3 - Using an algebraic modeling language for access to advanced solver features

Robert Fourer, Industrial Engineering and Management Sciences, Northwestern University, 2145 Sheridan Road, 60208-3119, Evanston, IL, United States, 4er@icms.northwestern.edu, David M. Gay

Algebraic modeling languages can conveniently support such diverse solver features as infeasibility diagnosis, quadratic convexity detection, multiple solutions, parameter tuning, generalized convexity domains, and logic operations in constraints. We present test results using the AMPL language to show how different features are applied and why they make a difference. AMPL’s variable and constraint suffixes are notable for their role in making a number of these features readily accessible.

TD-43
Tuesday 12:55-14:15
GSI - S 10
Health care and medical services for public, nursing, and school communities
Stream: Sustainable living: Cognitive, Social, Economical, Ecological and World View
Invited session
Chair: Annette Hohenberger, Middle East Technical University (METU), Informatics Institute, Cognitive Science Program, Inonu Bulvari, 06531, Ankara, Turkey, hohenberger@it.metu.edu.tr

1 - Headache diagnosis using artificial neural networks
Pedro Steiner Neto, Business, Federal University at Paraná, R. Pe. Anchietta, 1231, 80730-000, Curitiba, PR, Brazil, pedrosteiner@ufpr.br, Maria Teresinha Arns Steiner, Karina Borges Mendes

Headache is a very common and high cost disease, since studies show that it affects about 92% of the population. Through data collected on 2,177 patients with headache diagnosis, it is verified if Artificial Neural Networks (ANN) could be used as a recognizing tool of patterns for new patients diagnosis. The System is based on Perceptron ANN multilayers by using Neural Networks Toolbox for its implementation and training. On this paper, it is verified the use of AMPL as a diagnosis supporting tool, as a way to help physicians’ routines, as well as an educational tool on students training.

2 - Solving multiple scenarios in the combinatorial auction of school meals in chile
Mario Guajardo, University of Chile, 8370439, Santiago, Chile, maguajar@dii.uchile.cl, Jaime Catalan, Rafael Epstein, Daniel Yung, Cristian Martinez

The Chilean government provides 2 million meals daily to schoolchildren at an annual cost of USD 500 million. The catering is provided by firms chosen through a combinatorial auction. The bid evaluation process must solve multiple scenarios of a combinatorial optimization model. We describe the design of the auction and report that solution times can be significantly improved if the scenarios are solved in an appropriate order and the optimal solution to one scenario is used as the initial solution of another. Results reflecting these improvements are given for real instances of the auction.

3 - Policy assessment in air quality management using an integrated bottom-up modeling approach and environmental and public health externalities estimation
Alejandro Builes, Facultad de Minas, Universidad Nacional de Colombia, Crr 80 No 65 - 223, 57, Medellin, Antioquia, Colombia, elbuiles@gmail.com, Claudia Rave, Cristina Franco

An integrated analysis is proposed to urban and environmental policy assessment for Colombian cities by linking air quality management as an important variable in strategic land use planning, public health analysis, and mobility and industrial scenario modeling for decision making support. The analysis includes Markal model and EEE approach, externalities analysis methodology (morbidity, pollutants concentration, environmental noise and land use indicators information) and, scenario and prospective analysis. It results aim to support integrated project formulation for air quality improvement.

TD-44
Tuesday 12:55-14:15
GSI - S 16
Forecasting and Geospatial Modelling
Stream: Uncertainty and Environmental Decision Making
Invited session
Chair: Belinda Chiera, School of Mathematics & Statistics, University of South Australia, South Australia, Australia,, 5001, Adelaide, SA, Australia, belinda.chiera@unisa.edu.au
Chair: Daniel Zachary, The Resource Centre for Environmental Technologies, Centre de Recherche Public Henri Tudor - Luxembourg, Technoport Schlussgoart, 66, rue de Luxembourg, L-4421 Esch-sur-Alzette, L-4421, Esch-sur-Alzette, dan.zachary@tudor.lu

1 - Problems and errors in up- and down-scaling in environmental modelling for policy decisions
Ulrich Leopold, Resource Centre for Environmental Technologies, Public Research Centre Henri Tudor, 66, rue de Luxembourg, 4010, Esch-sur-Alzette, Esch, Luxembourg, Ulrich.Leopold@Tudor.lu

Environmental models are typically developed to study processes at a certain scale. Many models were developed for research purposes rather than for policy support. Therefore, often several models are combined into meta-models in order to arrive at estimates for the policy scale. The change of scale in such coupled models involves up- and down-scaling of model inputs, model parameters as well as adaptations of model equations. This paper aims to raise awareness of the impacts that up and down-scaling can have on the quality of model results.

2 - Sustainability screw: a mathematical perspective on some problems of environmental modelling
Jerzy Filar, Mathematics and Statistics, University of South Australia, Mawson Lakes Blvd, 5095, Mawson Lakes, SA, Australia, j.filar@unisa.edu.au

In this presentation, the author will discuss some concepts and results from the subjects of control theory and dynamical systems that appear to capture certain salient aspects of the challenges posed by the still poorly understood notion of “sustainable development”. In particular, as a consequence of interpretation of the latter, it will be argued that problems of climate change and environmental degradation are really only symptoms of the more fundamental problem of the lack of synchronization between time scales of human development and natural processes of the biosphere.
3 - Comparative forecasting and a test for persistence in the El Nino southern oscillation

Belinda Chiera, School of Mathematics & Statistics, University of South Australia, Australia, belinda.chiera@unisa.edu.au, Jerzy Filar, Daniel Zachary, Adrian Gordon

We present an analysis of two separate single-indicator forecasting methods for the El Nino Southern Oscillation based on oscillation persistence. We use the Southern Oscillation Index (SOI) to produce 5 month forecasts and a Bayesian approach to explore SOI persistence with results compared to a benchmarking Taylor Series expansion. We find signal persistence is important when forecasting more than a few months and the models presented may provide a relatively simple approach to environmental risk forecasting in situations where the underlying phenomenon exhibits substantial persistence.

4 - Uncertainty from model calibration — global models and regional data

Bas van Ruijven, Netherlands Environmental Assessment Agency (PBL), Antony van Leeuwenhoeklaan 9, 3712 MA, Bilthoven, bas.vanruijven@pbl.nl, Jeroen P. van der Sluijs, Detlef van Vuuren, Peter Janssen, Peter Heuberger, Bert J.M. de Vries

Uncertainties in energy demand modelling allow for the development of different models, but also leave room for different calibrations of a single model. We apply an automated procedure to analyse calibration uncertainty in energy use modelling of the TIMER 2.0 global energy model. The model simulates energy use on the basis of energy intensity changes, technology development and price responses. We found that different implementations of these factors yield behavioural model results. Model calibration uncertainty is identified as influential source for variation in future projections.

2 - Economic impact of new malaria diagnostic devices on the malaria control program in Brazil

Breedge Quinn, University Twente, Oberdorf, 53804 Much, NRW, Germany, b.p.quinn@student.utwente.nl, Marjan Hummel

This study focuses on the economic impact of a new malaria diagnostic device on the Malaria control processes in Brazil. Current diagnostic tools have disadvantages which prevent the total coverage of malaria risk regions. As a consequence, there is a high demand for a portable, fast, accurate device which can be used in remote settings. The objective of this research is to study the cost-effectiveness of new diagnostic devices. Process mapping and Markov modeling are used to gain insight in the expected cost reduction of overtreatment and improvement of health benefits for the patient.

3 - The complexity of healthcare handled by clients with the aid of Internet

Cor van Dijkum, Methodology and Statistics, Utrecht University, Heidelberglaan 1, 3508TC, Utrecht, Netherlands, c.j.vandijkum@uu.nl

E-health is improved by doing action-research. Decision support systems were developed to help(potential) clients with choosing professional help; to overcome their psychic problems and to participate in the modern society concerning work, housing and free time. By involving (ex)clients as associated researchers DSS knowledge was generated from inside experience. The decision support systems were also made interactive, to involve visitors of the website to add their own (ex) client’s knowledge to the website, and made it available for other (potential)(ex)clients.

1 - The complexity of the communication between gp and patient

Cor van Dijkum, Methodology and Statistics, Utrecht University, Heidelberglaan 1, 3508TC, Utrecht, Netherlands, c.j.vandijkum@uu.nl

The communication between a GP and a Patient is far more complicated than was thought in the medical profession. The social aspect of the communication, not well included in the medical education, is nowadays accepted as an element that can facilitate the medical diagnosis. Complex non linear models has to serve as a foundation for a model of the Patient-GP interaction. In earlier simulation studies the non chaotic dynamics of a model is reproduced with the aid of simulation software. In this paper the non linear chaotic dynamics of such models is further investigated by using Matlab.
Tuesday 14:30-15:50

■ TE-01

Tuesday 14:30-15:50

Beethoven

Excellence in Practice Award I

Stream: Excellence in Practice Award

Semi-plenary session

Chair: Geir Hasle, Applied Mathematics, SINTEF ICT, P.O. Box 124 Blindern, NO-0314, Oslo, Norway, Geir.Hasle@sintef.no

1 - Operations research improves quality and efficiency

Mikael Rönqvist, Department of Finance and Management Science, Norwegian School of Economics and Business Administration, NO-5045 Bergen, Norway, mikael.ronqvist@nih.no

Elderly care systems in the Western world are facing increased costs, primarily because the elderly constitute a growing percentage of the total population. It is a political aim to make it possible for elderly to keep living in their own homes. The result is increased quality of life as well as lower total cost for providing the care as compared to retirement homes. The care is performed through visits to the elderly, and a wide range of services are performed, including cleaning, washing, medical assistance and social support. The elderly care sector is labour intensive, and therefore good staff planning is necessary.

The planning of home care services involves many components such as scheduling of visits, routing of staff, matching between visit requirements and staff competences, fairness among staff members and quality of services. In addition, the daily operative planning has to deal with many last minute changes and is therefore difficult and time-consuming.

The City of Stockholm employs 47,000 staff members, of which 60% work within social care. The budget for 2008 is EUR 3.9 billion, and social care to elderly citizens and disabled persons is the city’s most expanding activity. The City of Stockholm has been using OR based decision support system, Laps Care, in a number of units since 2003. The system is used to create the daily operative plans, in which visits to elderly are allocated to staff members. The planning considers geographic information, calculates travel times for several transportation modes (car, bike and walking). With the system, the planning time is reduced by 2/3. This means that staff members can spend more time on visits, rather than participating in daily morning meetings. The use of resources is also more efficient, for example there is less need to call in extra staff.

This has resulted in increased efficiency of 10 — 15 %. The qualitative aspects such as continuity and a fair work load level among staff members and security against missed or re-scheduled visits are considerably improved.

Currently there are 200 units with 4,000 staff members in 50 Swedish municipalities that are using Laps Care, and the annual savings reported are EUR 20 — 30 million. During 2008/2009 the City of Stockholm is rolling out another 1,000 units with 15,000 staff members, and estimates to save EUR 20 — 30 million for the city alone.

2 - Scheduling the Chilean soccer league by integer programming

Guillermo Duran, Ingeniería Industrial, University of Chile, Republica 701, 1000, Santiago, Chile, gduran@dit.uuchile.cl, Mario Guajardo, Jaime Miranda, Denis Saure, Sebastián Symyris, André Wei ntraub, Rodrigo Wolf

Since 2005, Chile’s professional soccer league has used a game-scheduling system that is based on an integer linear programming model. The Chilean league managers considered several operational, economic, and sporting criteria for the final tournaments’ scheduling. Thus, they created a highly constrained problem that had been, in practice, unsolvable using their previous methodology. This led to the adoption of a model that used some techniques that were new in soccer-league sports scheduling. The schedules they generated provided the teams with benefits such as lower costs, higher incomes, and fairer seasons. In addition, the tournaments were more attractive to sports fans. The success of the new scheduling system has completely fulfilled the expectations of the Asociación Nacional de Fútbol Profesional (ANFP), the organization for Chilean professional soccer.

3 - Sequencing and scheduling in coil coating with shuttles

Marco Lübbecke, Institut für Mathematik, MA 5-1, TU Berlin, Straße d. 17. Juni 136, 10623, Berlin, Germany, m.luebbecke@math.tu-berlin.de, Wiebke Höhn, Felix G. König, Rolf Möhring

We consider coating of metal coils in integrated steel production. Between coils time-consuming setup work may be necessary. Devising a production plan is sequencing the coils, assigning coils to color tanks, and scheduling scarce work resources for setup work, partly performed concurrently with production. The aim is to minimize the makespan. We present a precise mathematical formulation of the entire problem, give algorithms to solve it, and prove the good quality of solutions via an integer programming model. Our algorithms are being introduced at Salzgitter Flachstahl AG.

■ TE-02

Tuesday 14:30-15:50

Schumann

Planning Problems with Dynamic Travel Times

Stream: Transportation Planning

Invited session

Chair: Karl Doerner, Department of Business Studies, University of Vienna, Brünnen Strasse 72, 1210, Vienna, Austria, karl.doerner@univie.ac.at

1 - Performance evaluation of dijkstra’s fastest path algorithm on realistic large street network with dynamic travel times

Senthanal Sirpi Manohar, Jakob Haringer Strasse 5/3, 5020, Salzburg, Salzburg, Austria, senthanal.manohar@salzburgresearch.at, Günter Kiechle

Computation of distance matrices is the basis for many applications in vehicle routing and tour optimization. Several shortest path algorithms were proposed in the literature to compute these matrices. The performance of shortest path algorithms is sensitive to properties of real-world street networks such as network size, representation of dynamic travel time, turn restrictions and penalties. The aim of this contribution is to evaluate the performance of Dijkstra’s algorithm by considering the properties of real-world street networks with dynamic travel times computed from floating car data.

2 - Coverage models with time dependent traveling times

Verena Schmid, Faculty of Business, Economics and Statistics, University of Vienna, Brünnen Strasse 72, 1210, Vienna, Austria, verena.schmid@univie.ac.at, Karl Doerner
For emergency service providers it is essential to locate and dispatch emergency vehicles while achieving adequate coverage. We extended the formulation of the double standard coverage model and emphasized locating more vehicles in densely populated areas. Furthermore, we also take into account variations in travel times and reallocations. The goal of this approach is to ensure coverage all day long and keep reallocations at a decent level. The problem is solved using VNS.

3 - A dynamic programming approach to multi-objective time-dependent single capacitated vehicle routing problems with time windows

Said Dabia, Den Dolech 2, 5600 MB , Eindhoven, s.dabia@tue.nl, Tom Van Woensel, Ton de Kok

A single vehicle performs several tours to serve a set of geographically scattered customers. The vehicle has a finite capacity and is only available for a limited amount of time. Because of road congestion, travel times are time-dependent: depending on the departure time at a customer, a different travel time is incurred. Furthermore, all customers need to get delivered in their specific time windows. We aim to minimize the total time travelled including any waiting times, while the total quantity delivered by the vehicle is maximized. Efficient dynamic programming algorithms are developed.

# TE-03

Tuesday 14:30-15:50
Reger

Location

Stream: Network Optimization
Invited session
Chair: Alessandro Tomazic, Faculty of Business, Economics and Statistics, Universität Wien, Brunner Str. 72, 1022, Vienna, alessandro.tomazic@univie.ac.at

1 - The center facility location/network design problem with budget constraint

Elena Fernandez, Statistics and Operations Research, Technical University of Catalonia, Campus Nord, C5-208, Jordi Girona, 1-3, 08034, Barcelona, Spain, e.fernandez@upc.edu, Ivan Contreras, Gerhard Reinelt

We present the Center Facility Location/Network Design Problem with Budget Constraint that combines location decisions to find a set of nodes to locate facilities and an allocation of nodes to facilities, with network design decisions to find a set of arcs to use for connecting the nodes and their allocated facilities. The cost of the facilities plus the selected arcs cannot exceed a given budget. The objective is to minimize the maximum travel distance from a node to its allocated facility in the graph induced by the selected arcs. We present a MIP formulation and discuss some properties.

2 - Ordered median hub location problems

Justo Puerto, Estadistica e I.O., Universidad de Sevilla, Facultad de Matematicas, 41012, Sevilla, Spain, puerto@us.es, Antonio Manuel Rodriguez-Chia, Ana Bel Ramos-Gallego

In this talk, we present new formulations for the uncapacitated single assignment ordered median hub location problem. We compare them and test their availability for being used in general purpose IP solvers. We derive several families of cuts for the different formulations and present a new branch and cut algorithm for this problem that enlarge the resolution sizes of this class of problems.

3 - Preprocessing connected facility location problems

Alessandro Tomazic, Faculty of Business, Economics and Statistics, Universität Wien, Brunner Str. 72, 1022, Vienna, alessandro.tomazic@univie.ac.at, Ivana Ljubic

We extend the definition of the Connected Facility Location Problem by allowing pre-opened and pre-fixed facilities. This new concept is advantageous for applying complex sequences of reduction tests. Besides transferring existing techniques designed for the Facility Location, Steiner Tree and Group Steiner Tree Problem, specific new reduction methods are introduced. We also propose an efficient self-adaptive preprocessing strategy based on test data dependencies and impacts. Computational studies show that the computational effort of our exact approach benefits and heuristic results are improved.

# TE-04

Tuesday 14:30-15:50
Liszts

Production Scheduling

Stream: Scheduling
Invited session
Chair: Chi-H-Wei Chiu, Graduate Institute of Management Sciences, Tamkang University, 151 Ying-chuan Road Tamsui, Taipei County Taiwan 25137, Republic of China, 25137, Taipei County, z35899@yahoo.com.tw

1 - Minimizing sequence-dependent setup costs under due date restrictions

Stefan Bock, WINFOR (Business Computing and Operations Research) Schumpeter School of Business and Economics, University of Wuppertal, Gaußstraße 20, D-42097 Wuppertal, 42097, Wuppertal, NRW, Germany, sbock@winfor.de, Kathrin Klamroth

We address the minimization of sequence-dependent setup costs under due date restrictions. Analogously to the model of Gilmore and Gomory, total setup costs for changing between different jobs are assumed to be proportional to absolute state differences. We show that the integration of due dates still leads to a strongly polynomial problem if the number of setup states is a constant. In order to solve the problem, a best-first Branch & Bound algorithm is introduced. By making use of additional dominance rules, problem instances of larger size can be solved optimally.

2 - Multi-product economic lot scheduling problem with manufacturing and remanufacturing: a new heuristic

Simone Zanoni, Dipartimento di Ingegneria Meccanica, Università di Brescia, via Branze 38, 25123, Brescia, Italy, zanoni@ing.unibs.it, Anders Segerstedt

We study the multi-item economic lot scheduling problem (ELSP) with two sources of production: manufacturing and remanufacturing. Tang and Teunter (2006) (firstly studied this problem (named ELSPR) presenting an algorithm for this problem that determines the optimal solution within the class of policies with a common cycle time and a single (re)manufacturing lot for each item in each cycle. Relaxing these constraints we propose a simple heuristic easy implementable based on Segerstedt (1999); numerical study shows applicability of the heuristic and the savings that can be obtained.

3 - Construct a model for scheduling problem of make-to-order production

Mei-Hsiu Chen, Graduate Institute of Management Sciences, Tamkang University, 151 Ying-chuan Road
This study mainly constructs a mathematical model focusing on production scheduling problem of make-to-order production where multiple orders, multiple types of products, manufacturing cost, resource cost, holding cost, and tardiness cost are considered for achieving the maximum profit. The syntax of Lingo 9.0 is applied to concrete and solve the proposed model. This study creates a highly repetitive characteristic because while facing different situations of the proposed problem, an enterprise can easily solve such a problem by changing the input parameters only.

4 - Production scheduling of supply chain system

Chih-Wei Chiua, Graduate Institute of Management Sciences, Tamkang University, 151 Ying-chuan Road Tamsui, Taipei County Taiwan 25137, Republic of China, 25137, Taipei County, z35899@yahoo.com.tw, Chun-Hsiung Lan, Hai-Ming Chen, Mei-Hsiu Chen

This study aims to construct a supply chain system by using two models. The first model is the main frame of supply chain, and purchase, production, inventory, distribution, purchase, and purchase are considered to solve the optimization. In addition, based on the optimal production quantity, the second model is applied to reveal the suggested layout of the production system. The syntax of Lingo 9.0 and Visual Basic 6.0 is applied to achieve the optimum solutions of the proposed models respectively. This study provides a referenced tool to an enterprise for a supply chain system.

3 - Towards prediction of hcv therapy efficiency

Szymon Wasik, Institute of Computing Science, Poznan University of Technology, ul. Piotrowo 2, 60-965, Poznan, Poland, zszym.wasik@cs.put.poznan.pl, Piotr Formanowicz, Jacek Blazewicz

We investigate a correlation between genetic diversity of HCV population defined using Hamming distance between RNA sequences and the level of viral RNA accumulation in patient blood. We have found that a low distance (i.e. low genetic diversity) correlates with a high RNA level and high diversity corresponds to a low RNA level. We contend that the obtained correlation strength justifies the use of the RNA level as a measure enabling prediction of efficiency of an established therapy. We also propose that patient qualification for therapy, based on viral RNA level, improves its efficiency.

2 - Modeling misclassification of populations in clinical national quality measures that are based on computerized patient records

Gad Rabinowitz, Department of Industrial Engineering and Management, Ben Gurion University of the Negev, P.O.B. 653, Beer Sheva 84105, 84105, Beer Sheva, Israel, rgadi@bgu.ac.il, Ron Weitzman
Background: The Israeli health quality indicators use proportion measures where the denominator and numerator populations are extracted from Computerized Patient Records for the entire population. Goals: Develop methods to estimate the magnitude and distribution of misclassification and identify its causes. Methods: We used Markov-Chain Monte-Carlo to model the distribution and on-site auditing to detect causes and obtain priors. Results: A framework to identify and evaluate misclassification was developed, leading to enhanced uniformity and accuracy of the health quality indicators.

3 - Fast multilevel solver for quadratic optimization under planar density constraints

Dorit Ron, Applied Mathematics and Computer Science, The Weizmann Institute of Science, POBox 26, 76100, Rehovot, Israel, dorit.ron@weizmann.ac.il, Illya Safro, Achi Brandt

We address the problem of finding an optimal layout for a set of 2D connected objects (modeled by a graph) by minimizing the total length of the connections and the overlap between them while utilizing the given 2D space. This problem poses a computational bottleneck in many fields: in graph visualization, facility location problem, etc. We have developed a fast multilevel solver for the core part of those applications, i.e., the problem of minimizing a quadratic energy functional under planar constraints that bound the allowed amount of areas in various sub domains of the entire given domain.

4 - A research of mapmaking with planning techniques

Omur Esen, Geodesy and Photogrammetry, Selcuk University, Division of Cartography, 42031, Konya, Selcuklu, Turkey, omuresen@hotmail.com, I.Bulent Gundogdu

Digital map production in Turkey is realized by some government-technical foundations. This paper elaborates current map production of 103 hectares area whose building number is approximately 33 per hectare, which tendered by General Directorate of Provincial Bank. At first, tables have been made, considering activities and their relations. Then according to this table planning has been realized with Gantt and Critical Path Method methods. Then by estimating shortest (a), potential (m) and the worst (b) time values, expected time (t) values were obtained and compared for PERT and TOC planning methods.

**TE-07**

Tuesday 14:30-15:50

GSI - S 29

Robust vehicle and crew scheduling

Stream: Optimization in Public Transport

*Invited session*

Chair: Natalia Kliewer, Information Systems and Operations Research, University of Paderborn, Warburger Str. 100, 33100, Paderborn, Germany, kliewer@upb.de

1 - A business perspective to robust airline planning

Ivo Nowak, NetLine Optimization Solutions, Lufthansa Systems, Salzufer 8, 10587, Berlin, Germany, ivo.nowak@lhsystems.com, Ralf Bornröter, Ivan Dovica, Thomas Schickinger

Since airline schedules of today have often little slack and limited recovery opportunities, flights are frequently disrupted leading to significant additional recovery costs and lower passenger punctuality. Recent approaches in robust optimization make it possible to reduce the impact of flight disruptions. A main difficulty in applying these techniques to a real-world problem is to find an appropriate recovery model under uncertainty. In this talk we discuss opportunities and challenges in robust airline scheduling from a business process point of view.

2 - Column generation approach to robust tail assignment

Ivan Dovica, Optimization, Konrad-Zuse-Zentrum für Informationstechnik Berlin, Takustrasse 7, 14195, Berlin, Germany, dovica@zib.de, Ralf Bornröter, Ivo Nowak, Thomas Schickinger

This talk deals with a robust version of the tail assignment problem, which considers the routing of individual aircraft. We model this problem as optimization problem in which non-robustness costs are minimized. Our approach is based on a stochastic model of the operation of an airline. In our talk we propose possible measures of robustness such as expected propagated delay, and solve the robust tail assignment problem by column generation technique.

3 - Stochastic column generation for crew pairing optimization

Viktor Dück, University of Paderborn, 33098, Paderborn, Germany, dueck@dsor.de, Natalia Kliewer, Leena Stuhl

We propose a method for the stochastic crew pairing problem based on dynamic column generation. The dynamic column generation method is essential to solve crew pairing optimization problems of realistic size, but is very hard to apply to stochastic programs. The proposed method speeds up the stochastic evaluation of similar pairings and similar master solutions, by decomposing the second stage of the stochastic program following the Dantzig-Wolfe Decomposition of the original problem.

4 - Robust optimization for delay-tolerant vehicle schedules

Stefan Kramkowski, Decision Support & OR Lab, University of Paderborn, Warburger Str. 100, 33098, Paderborn, Germany, kramkowski@dsor.de, Natalia Kliewer

In public bus transport delays occur frequently during the transportation process. Thus, schedules become infeasible and the operations control center has to undertake expensive actions. We present different offline approaches based on robust optimization to increase delay-tolerance of vehicle schedules. In doing so, the main focus is on introducing buffer times to cope with minor disruptions and to control delay propagation. Computational results for real-life timetables from German cities compare the approaches with regard to planned operational costs and delay-tolerance.

**TE-08**

Tuesday 14:30-15:50

GSI - S 30

Supply Chain Planning Practice

Stream: Supply Chain Management

*Invited session*

Chair: Moritz Fleischmann, Rotterdam School of Management, PO Box 1738, 3000DR, Rotterdam, Netherlands, MFleischmann@rsm.nl

1 - Modelling uncertainties in supply chains — challenges and algorithmic approaches

Simone Gast, Lehrstuhl für Angewandte Mathematik II, Universität Erlangen-Nürnberg, Martensstr. 3, 91058, Erlangen, Germany,
In designing and optimizing logistic supply chains several uncertainty factors need to be taken into account. Considering e.g. variable currency rates or raises in transport costs is substantial when planning logistic networks. Therefore, the goal of cost-effectiveness in traditional network optimization needs to be extended. Our goal is to develop optimization techniques that guarantee a certain level of robustness and flexibility. We survey different robustness concepts and present new ideas for dealing with the challenges described above. The approaches are illustrated at a case study.

2 - Strategy lifecycle for entering and operating emerging markets

Florian Köhne, Abteilung Supply Chain Management, Fraunhofer-Institut für Materialfluss und Logistik, Joseph-von-Fraunhofer-Strasse 2-4, 44227, Dortmund, Germany, Florian.Koehne@iml.fraunhofer.de

The different strategies to enter new car markets are well-known, but one important problem is the identification of the right strategy. Currently OEM try to answer this question with inaccurate approaches. This paper addresses a holistic approach to enter and operate emerging markets which needs multiple requirements. Based on a criteria catalog a quantitative and qualitative method will be presented which allows fast decision support to identify the shifting point from one strategy to another during the product lifecycle.

3 - Bayaps®-ds - a software tool for generation of a long-term production plan at a bayer site

Thomas Kampmeyer, Process Management Technology, Bayer Technology Services GmbH, 51368, Leverkusen, Germany, thomas.kampmeyer@bayertechnology.com

In this presentation our production planning software tool for the next 9 months at a Bayer Crop Science AG site is presented. The production is a multi-stage batch process with several additional constraints regarding diversification of production, downsizing the setup works, length of the campaigns. In the talk the basic model and the underlying solution method is introduced. The aim is to avoid late deliveries and to produce campaigns as large as possible. The solution method has to take into account several thousand orders which have to be produced on around 30 machines.

4 - Optimizing closed loop supply chain network design with sustainability consideration

Vildan Ozkir, Barbaros Bulvarý Yýldýz Teknik Üniversitesi Endustri Muhendisliği Bolumu Beşiktaş, 34349, Istanbul, Turkey, vildanozkir@gmail.com, Huseyin Basgili

This paper reveals the main features of establishing a closed-loop supply chain (CLSC) including recovery processes and develops a mathematical model of a general CLSC network which includes plants, collection points, reverse centers, recovery facilities, distribution centers and consumers. The objective of this paper is to formulate a goal programming model including environmental, social and economical dimensions of sustainability for the most attractive profit value. Finally, we applied proposed model to an illustrative case. Finally, concluding remarks are made regarding the results.
Personnel scheduling is usually treated by decomposition into building blocks, some of which may be treated in an integrated approach. When there is a great proportion of flexible demand, in a multi-skilled workers environment, it becomes interesting to solve shift scheduling and rostering as one problem. Additionally, the integrated approach allows also to better model breaks scheduling and days-off scheduling. Alternative MIP formulations are presented which lead to optimal shift scheduling and task assignments. Computations results show the improvement obtained by extended formulations.

1 - Multicriteria group decision model for rehabilitation of water supply infrastructure

Danielle Morais, Dept. of Production Engineering, UFPE, R. Cons. Portela, 169/ap. 701, Espinheiro, 52020-030, Recife, Pernambuco, Brazil, dcmorais@ufpe.br, Adiel Teixeira de Almeida

The rehabilitation of water supply infrastructure is a complex activity and requires different actions from management, besides involving actors having sometimes divergent objectives and different interests. This paper presents a multicriteria group decision model based on the analysis of individual rankings with the aim of choosing an appropriate alternative, which is the best compromise according to the point of view of all the actors involved in the decision problem.

2 - Model structure for monitoring critical activities in project management based on multiple criteria decision aid

Caroline M Miranda Mota, Federal University of Pernambuco, 50000000, Recife, PE, Brazil, carolmm@ufpe.br, Adiel Teixeira de Almeida

Project management is a very growing area of study and therefore problems related to projects have become a global phenomenon. This study presents a model structure for supporting the selection of critical activities in project management based on multiple criteria decision aid (MCDA) approach. MCDA approach takes into account several points of view. The proposed model improves the monitoring of activities in project management, particularly in a dynamic environment. A case study on the IT projects is used to demonstrate the model proposed.

3 - Multi-criteria model to aid liquefied petroleum gas distributors in their classification of clients

Ana Paula Costa, Federal University of Pernambuco, 50.000-000, Recife, PE, Brazil, apcabral@ufpe.br, Marcos Felipe Sobral

Liquefied petroleum gas (LPG) is a fossil fuel of great prominence on the world market due to its versatility with regard to logistics, to its calorific power and to its low emission of pollutants. Given the importance of LPG, the process of how LPG distributors should classify their clients is a strategic task. In this context, this paper puts forward a multi-criteria model to support LPG distributors in their problem of how best to classify clients. A model is proposed based on the ELECTRE TRI method which allocates the clients in a distributor’s portfolio to a group of ranked classes.

4 - Multicriteria models in outsourcing decision problems

Adiel Teixeira de Almeida, Management Engineering, Federal University of Pernambuco - UFPE, Cx. Postal 7462, 50630-970, Recife, PE, Brazil, almeidaatd@gmail.com, Juliana Regueira Abath

Multicriteria decision models for outsourcing contract problems are presented. These models are also related to outsourcing vendor selection. For each alternative of an outsourcing contract there is an evaluation of cost and performance criteria related to the quality of service, which may include probabilistic delivery time and confidence in quality commitment, for instance. Different methods have been used such as MAUT and ELECTRE according with the context and preferences structures. The paper discusses the formulation of the decision model and its application.

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4 - Multicriteria models in outsourcing decision problems

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02015, TKK, Finland, juSSI.kangaspunta@tkk.fi, Juuso Liesiö, Ahti Salo

Cost-efficiency evaluation of weapon systems is challenging due to multiple mission objectives, interactions among weapon systems and variety of operating situations where these systems may be used. We develop a portfolio modeling framework to identify cost-effective combinations of weapon systems at different budget levels in view of multiple mission objectives. The modeling framework — which builds on results from combat simulations — admits incomplete information about the importance of mission objectives and accounts for interactions that exist among dissimilar weapon systems.

3 - A portfolio model for the allocation of resources to standardization activities
Antti Toppila, Systems Analysis Laboratory, Helsinki University of Technology, P.O. Box 1100, Otakaari 1 M, 02015, TKK, Finland, antti.toppila@tkk.fi, Ahti Salo, Juuso Liesiö

High-technology companies seek to strengthen their technological competitiveness through standardization activities that contribute to enhanced interoperability and market growth. We present a standardization portfolio model that was developed for a major telecommunication manufacturer for the allocation of standardization resources. This model captures relationships between (i) standardization and development efforts and (ii) expected sales increases that can be achieved through widely adopted technologies. The resource allocation recommendations are robust to the model parameters.

4 - Interrelationships between the funding portfolios of research groups and their scientific outputs
Matti Ollila, Systems Analysis Laboratory, Helsinki University of Technology, 02015, Helsinki, Finland, Matti.Ollila@tkk.fi, Ahti Salo, Antti Silvast

In many countries, research groups at universities are increasingly dependent on several external sources of funding as the share of basic funding has tended to decline. We develop two frameworks for examining interrelationships between external funding and scientific outputs, based on aggregated data about the activities of research groups. The first framework is a phased model of the activities involved in attracting and using external funding. The second is an input-output model where the groups’ scientific outputs (e.g. doctoral degrees) are attributed to corresponding funding sources.

We propose a new framework for the solution of probabilistic optimization problems by using combinatorial pattern theory. The method involves the binarization of the probability distribution F and the generation of a partially defined Boolean function (pDBF) representing the combination (F,p) of F and the probability level p and taking the form of a disjunctive normal form (DNF). We present several optimization-based methods for the construction of a DNF that defines necessary and sufficient conditions for the probabilistic constraint to hold. A numerical implementation will be discussed.

2 - Robust approach for aerospatial optimal control problems
Jean-Philippe Chancelier, CERMICS, Ecole des Ponts, 6 et 8 Av Blaise Pascal, Cite Descartes, Champs sur Marne, 77455, Marne La vallée cedex 02, France, jpc@cermics.enpc.fr, Guy Cohen, Pierre Carpentier

The purpose of this work is the planning of spatial rendez-vous which can be formulated as optimal control problems with terminal constraints and minimal terminal time and/or fuel consumption goals. The derived optimal control is not robust in that the possibility of satisfying the terminal constraints once a breakdown of the engine occurred may be very weak. We propose a formulation in which the final constraints are replaced by a constraint in probability. The goal is to plan a trajectory achieving the rendez-vous despite engine breakdowns, with a given probability.

3 - A model for dynamic chance constraints in water reservoir management
Laetitia Andrieu, OSIRIS, EDF R&D, 1 avenue du Général de Gaulle, 92140, Clamart, laetitia.andrieu@edf.fr, Rene Henrion, Werner Römisch

Chance constraints play an important role in many engineering problems affected by uncertain data. In this talk, we develop a model for joint dynamic chance constraints relying on discretization of the decision variables but not of the probability distribution; this builds a bridge to existing methods for (continuous) static chance-constrained problems. The model is then illustrated through numerical examples from the application in water reservoir management for a small number of stages.

1 - Lp-rounding and local search techniques to solve a multi-period facility relocation problem
Teresa Melo, Department of Business Administration, University of Applied Sciences, Waldhauwesweg 14, D-66123, Saarbrücken, Germany, teresa.melo@htw-saarland.de, Francisco Saldanha-da-Gama, Stefan Nickel

A new heuristic approach is proposed to solve a multi-echelon, multi-product facility relocation model. Capacity transfers from existing facilities to new sites are to be planned over a finite time horizon subject to budget constraints. The objective is to redesign the supply chain network so as to minimize the sum of variable costs associated with production, inventory and transportation activities, and fixed costs for facility operation. An initial feasible solution is obtained using an LP-rounding strategy. Post-optimization is applied combining variable neighbourhood and token ring search.
For some industries, like process industry, it is difficult to produce exactly the required replenishment quantity, due to, e.g., yield problems. Hence the optimal control parameter is more a target than an exact result. We provide a method to deal with this uncertainty in inventory control by considering the control parameters to be random, unlike classical inventory control. We apply our method to a periodic review, order-up-to policy, in which the length of the review period, the lead time and the order-up-to level may be random.

2 - Stochastic lead time models for inventory management

Thomas Wensing, Chair of Production Management, Catholic University of Eichstaett-Ingolstadt, Auf der Schanz 49, 84049, Ingolstadt, Germany, thomas.wensing@ku-eichstaett.de, Heinrich Kuhn

Analytical models of inventory systems commonly assume identical independent distributed lead times to reflect stochastic influences in the replenishment process. Furthermore, replenishment orders may not crossover, i.e. arrive in a different order than they were issued — a property that clearly challenges the assumption of independence. In this context, we examine three lead time models. The first meets both assumptions, the second rules out order-crossover at the price of dependent lead times and the third allows for orders to crossover.

3 - Pharmaceutical supply chain and inventory decisions for a hospital

Peter Kelle, ISDS, Louisiana State University, CBEA, 70810, Baton Rouge, Louisiana, United States, qmkell@lsu.edu, Helmut Schneider, John Woosley, Sonja Wiley-Patton

We discuss the different often conflicting goals in pharmacy supply chains and provide quantitative tools for improvements in the pharmacy inventory management system of the hospital. We provide simple, close to optimal rules for the safety stock and cycle stock allocation under space constraint. We provide a decision support tool to analyze the trade-offs among the three key performance indicators: the service level (emergency refill workload), the available space (depending on the variety of drugs — formula), and the number of orders (refill workload).

4 - Warehouse space allocation problem in a carpet factory considering multiple criteria

Muammer Ekinci, Department of Industrial Engineering, Erciyes University, 38039 Kayseri, Turkey, 38039, Kayseri, Turkey, ekinci.muammer@gmail.com, Banu Soylu

This study addresses a space allocation problem for different yarn hobbins in a carpet factory based on multiple criteria. The factory produces yarn for carpet production. Currently, the warehouse space is not used efficiently. The problem is to determine the space that should be reserved for each type of yarn. In this study, a warehouse space allocation policy is developed with respect to the yearly demand of yarn types and color tone inconsistency criteria. We apply an ABC analysis and DEA based approach. We discuss different scenarios and compare the results with the current situation.
Reactive power compensation (VAR planning) is an important issue in electric power systems, being directly related with efficient delivery of active power to loads. The problem consists in selecting the network nodes to install capacitors as well as their dimension. The mathematical model includes two objective functions concerning costs and system losses, while the bus voltage profile and power flow equations are considered as sets of constraints. The results of an elitist Non-dominated Sorting Genetic Algorithm enhanced with local search for computing non-dominated solutions are presented.

2 - Morphological system design and multicriteria decision making

Mark Sh. Levin, Inst. for Inform. Transmission Problems, 19 Bolshoj Karetny Lane, 127994, Moscow, Russian Federation, mslevin@acm.org

Design of system configurations is examined. Modifications of morphological analysis (MA) are considered as multicriteria decision making procedures based on combinatorial optimization. The following methods are studied: (i) MA, (ii) MA based on proximity to ideal point(s), (iii) MA based on linear programming, (iv) multicriteria multiple choice problem, (v) QAP, (vi) Pareto-based MA, (vii) Hierarchical Morphological Multicriteria Design (HMMD) approach, and (viii) HMMD approach based on probabilistic/fuzzy estimates. The methods are illustrated by examples, and applications.

4 - New data mining based approach for multi-objective optimisation

Jingpeng Li, School of Computer Science, University of Nottingham, JUbiilee Campus, Wollaton Road, NG8 1BB, Nottingham, Nottinghamshire, JPL@cs.nott.ac.uk, Edmund Burke, Rong Qu

In this approach, we first generate an initial solution and then use any local search method to identify a new solution. Compromise programming is investigated to evaluate the quality of the new solution under multiple objectives. Later, we use a falling tide search to determine the acceptance of this solution, and update an obtained Pareto set. The above steps are iterated, until a stopping condition is met. In the meantime, we employ data mining methodologies to aid or speed up the search. We can use this to predict the quality of resulting solutions without calculating the objective values.

Metaheuristics in Multi-Objective Optimization

Stream: Multi-Objective Optimization and Decision Theory 1

Carlos Henggeler Antunes, DEEC, University of Coimbra and INESC Coimbra, Rua Antero de Quental 199, 3000-033, Coimbra, Portugal, ch@deec.uc.pt

1 - A genetic algorithm with local search for reactive power compensation in electrical networks

Cutting and Packing 7

Stream: Cutting and Packing

Invited session

Chair: A. Miguel Gomes, Faculty of Engineering / INESC Porto, University of Porto, Rua Dr. Roberto Frias s/n, 4200-465, Porto, Portugal, agomes@fe.up.pt

1 - Dynamic multi-period scheduling of cutting and sequence-dependent setup operations

Harald Reinertsen, Leeds School of Business, University of Colorado at Boulder, 419 UCB, 80309-0419, Boulder, CO, United States, Harald.Reinertsen@colorado.edu, Thomas Vossen

Cutting and sequence dependent setup operations commonly appear in a stochastic and dynamic setting on an infinite horizon where orders arrive and are filled within due dates. These problems have a common structure where the cost of production depends on the other orders in the system. Because of this special problem structure, approximating future orders and taking advantage of order selection and postponement strategies in planning the next period leads to significant improvements in scrap and setup time as well as on-time delivery of orders.
2 - Pallet design and distribution planning for an integrated beverage manufacturer—chain market system

Rifat Gürcan Özdemir, Industrial Engineering Department, Istanbul Kültür University, Ataköy Campus, Ataköy-Bakirköy, 34156, İstanbul, Turkey, rg.ozdemir@iku.edu.tr, Tülin Aktın, Filiz Avcı

This paper proposes the joint pallet design and distribution planning problem for a system involving a single manufacturer and multiple chain markets. Given demands of customers, the first level generates mixed pallet design alternatives to minimize total unused pallet spaces. The resulting alternative pallet designs including multiple products are input to the second level. This level determines a distribution plan for a global objective function in which the overall costs of the integrated system are minimized. The approach is implemented using GAMS software in a real industrial problem.

3 - Lp-based branching schemes in the orthogonal packing feasibility problem

Gleb Belov, Numerical Mathematics, TU Dresden, 01062, Dresden, Germany, bg37@gmx.net

The Orthogonal Packing Feasibility Problem (OPP) asks whether a given set of cuboid items can be orthogonally packed in a given cuboid container. The natural model of OPP operates with item coordinates. The interval graph model of OPP considers overlapping relations of item projections on the coordinate axes. Today’s state-of-the-art exact approaches operate with these models and apply combinatorial heuristics for branching decisions. We propose new branching schemes for OPP based on 1D LP relaxations and both on natural and interval graph models.

4 - A hybrid approach to the rectangle packing area minimization problem

A. Miguel Gomes, Facultad de Ingeniería / INESC Porto, University of Porto, Rua Dr. Roberto Frias s/n, 4200-465, Porto, Portugal, agomes@fc.up.pt, Marisa Oliveira, Mª Eduarda Pinto Ferreira

In the Rectangle Packing Area Minimization Problem (RPAMP) one wishes to pack a set of non-overlapping rectangles while minimizing the enclosing rectangular area. This problem is applicable to a wide range of activities, such as Very Large Scale Integration (VLSI) module placement and facility layout (FL). In this work we propose to tackle the RPAMP with a hybrid approach of iterated local search (ILS) with linear programming models (LP).

2 - Pivoting in linear complementarity: two polynomial-time cases

Jan Foniok, Institute for Operations Research, ETH Zurich, HG G 22.2, Rämistrasse 101, 8092, Zurich, Switzerland, foniok@math.ethz.ch, Komei Fukuda, Bernd Gärtner, Hans-Jakob Lüthi

We demonstrate that unique-sink orientations of cubes are a useful combinatorial tool for studying the behaviour of simple principal pivoting methods for the P-matrix linear complementarity problem (P-LCP). We solve an open problem of Walter D. Morris by showing that Murty’s least-index pivot rule (under any fixed index order) leads to a quadratic number of iterations on Morris’s highly cyclic P-LCP examples. We then show that on K-matrix LCP instances, all pivot rules require only a linear number of iterations.

3 - Parameter estimation in stochastic differential equations by modern continuous optimization

Gerhard-Wilhelm Weber, Institute of Applied Mathematics, Middle East Technical University, ODTÜ, 06531, Ankara, Turkey, gweber@metu.edu.tr, Pakize Taylan, Ayşe Özmen, Nuket Erbil, Cem Ali Göksen

Stochastic differential equations play an increasing role in financial mathematics, in sciences and technology. We identify their parameters by various kinds of estimation, e.g., nonlinear regression, additive models with splines, MARS and the recently introduced C-MARS. We present and discuss the use techniques such as Levenberg-Marquardt method and conic quadratic programming with interior point methods. Our optimization problems also include regularization terms to prevent from overfitting. We discuss structural frontiers and present research challenges.
We study a practical distribution problem encountered in a food company in Denmark. The problem is to determine routes for a fleet of heterogeneous vehicles and assign the routes to a number of drivers over a week such that the customers are supplied within their time windows. Furthermore, the drivers can not work for more than 37 hours per week. Special driving rules must be respected, e.g., a 45-minute break must be ensured after 4.5 hours driving. The objective is to minimize the total traveling distance. A variable neighborhood search is developed. Preliminary results will be presented.

2 - On the use of run time distributions to characterize stochastic local search algorithms

Celso Ribeiro, Department of Computer Science, Universidade Federal Fluminense, Rua Bogari 70, 22471-340, Rio de Janeiro, RJ, Brazil, celso@inf.puc-rio.br, Isabel Rosseti, Reinaldo Vallejes

We explore run time distributions and describe a new tool to compare two algorithms based on stochastic local search. For the case where the running times of both algorithms fit exponential distributions, we derive a closed form index that gives the probability that one of them finds a solution at least as good as a given target value in a smaller computation time than the other. This result is extended to the case of general run time distributions and a numerical iterative procedure is described for the computation of the above probability value.

3 - Performance evaluation of universities from the students’ perspective

Regina Schlindeinweg, Institut für BWL (510A), 30 University of Hohenheim, Schloss Osthof Nord, 70599, Stuttgart, Germany, r.schlindeinweg@uni-hohenheim.de

One of the most popular evaluations of universities in Germany is the CHE-Rankings conducted annually since 1998 by the Centrum für Hochschulentwicklung. This ranking builds three ranking groups for different criteria. Based on the CHE data, especially surveys among students, we evaluate teaching performance from the students’ perspective through a data envelopment analysis (DEA). We use a DEA bootstrap approach to consider stochastic influences in the data. Moreover we are able to identify stochastic dominance relations between university departments.

4 - Efficiency analysis of islamic banks: a case of gulf cooperation council (gcc)

Abdel Latef Anouze, Aston Biusinessness, Aston University, 5 Colchester Street, CV1 5NY, Coventry, United Kingdom, aamajed2001@hotmail.com, Ali Emrouznejad

This paper aims to analyze the efficiency and productivity change of 70 commercial banks: Gulf Cooperation Council (GCC) cases over period 2000-2007. To deal with negative data, the semi-oriented radial model, the modified slacks based model and the range directional model were employed. Statistical tests are used for cross country comparison and for comparison between Islamic and Conventional banks. Our findings are that Islamic Banks are more efficient than Conventional Banks in GCC. Cross-countries analysis shows that the countries with less concentration banks are more efficient.
2 - Multi-attribute decision support for project portfolio of railway infrastructure
Majda Bastić, Faculty of Economics and Business, University of Maribor, Razlagova 14, 2000, Maribor, majda.bastic@uni-mb.si
In Slovenia, the construction of railway infrastructure within TEN will be carried out on the traffic corridors V and X within ten projects. Considering strategic objectives, TEN requirements and financial possibilities of investors the model was developed to find project portfolio which meets those requirements as much as possible. First, multi-criteria decision analysis was applied to rank projects with respect to macroeconomic and infrastructural criteria. In order to determine the start of the project they are grouped in stages with respect to the available financial funds of investors.

3 - The analytic hierarchy process for the social complex problems analyses
Rina Manuela Contini, Scienze Sociali, Università Chieti-Pescara, Via di Vestini, 31, 66013, Chieti, Italy, rm.contini@unich.it, Antonio Maturo
The aim of this study is to show how the Analytic hierarchy process can be an adequate tool to analyze the social complex problems. Specifically, the AHP is applied to analyze the complex and multidimensional phenomenon of foreign students’ school integration. For this purpose a case study is presented in which, according to inquiries conducted with teacher’s interviews an order of priorities is presented in which satisfactory alternatives are placed, in different measures, having prescribed choice criteria.

4 - Making better decisions by integrating GIS with AHP
Turan Erden, Geodesy and Photogrammetry, Istanbul Technical University, Istanbul Teknik Üniversitesi, İsmail Fakultesi, Jeodezi ve Fotogrametri Mühendisliği Bölümü, 34469, Istanbul, Turkey, erdentur@itu.edu.tr, Ozay Ozaydin, Y. İker Topçu
As systems become more complex, decision support systems require an evolution. The integration of analytical hierarchy process (AHP) with the geographical information systems (GIS) combines decision support methodology with powerful visualization, mapping and analyzing capabilities which should considerably facilitate i.e. creation of the suitability maps, location selection problems and critical areas for specific resource management and control practices. In this study, the effects of integrating GIS with analytical hierarchy process are investigated with respect to before-mentioned aspects.

Because of large economic and environmental asymmetries among world regions and the incentive to free ride, a Post-Kyoto international climate regime with broad participation is hard to reach. Using the CGE model DART we compare different stylized regimes with respect to the distribution of economic costs and in particular the incentives for the developing countries to participate. The regimes include a harmonized international carbon tax and cap and trade systems with different popular allocation rules for the emission caps. Also we calculate the carbon content of trade.

2 - Relevance of industrial sectors for emission trading in an optimizing energy system model
Lutz Hillemacher, Institut für Industriebetriebslehre und Industrielle Produktion (IIP), Universität Karlsruhe (TH), Hertzstraße 16, 76187, Karlsruhe, Germany, Lutz.Hillemacher@kit.edu, Christoph Nolden, Dominik Möst, Wolf Fichtner
The energy and material flow model PERSEUS has been developed to give decision support for strategic planning of energy utilities in liberalised energy markets and to provide a tool for deriving electricity and CO2-certificate prices. The model determines the 'optimal' structure of the future energy system of an electric utility for a typical time horizon of about 30 years considering environmental constraints like emission restrictions. In our contribution, relevant industrial sectors are included and their influences on emission trading and CO2-certificate prices are analysed.

3 - The decision value of a future fusion power plant in an emissions trading system
Heinz Eckart Klingelhöfer, Knopstraße 1, 17489, Greifswald, Germany, hekling@web.de, Peter Kurz
This paper outlines an approach to valuating a future fusion power plant in imperfect markets. We use simultaneous calculation of optimal production, trading and investment programs under characteristic constraints. Duality theory allows to interpret the determinants of the price ceiling as (corrected) Net Present Values. Although fusion power itself will be CO2-emissions free, emissions trading will affect the profitability of a fusion power plant via its alternatives. Hierarchical planning combines the advantages of the accurate simultaneous approach with reduced complexity.

1 - An option-based revenue management procedure for strategic alliances
Michaela Graf, Mercator School of Management, Chair of Logistics, University Duisburg-Essen, Lotharstr. 65, 47057, Duisburg, Germany, michaela.graf@uni-duisburg-essen.de, Alf Kimms
We propose a capacity control process for strategic alliances, which determines the booking limits as control variables in the capacity control with the aid of real options. The booking limits are calculated in an iterative process with simulation-based optimization. In a computational study the results of the simulations-based optimization will be compared with the results of a FCFS-approach and the ex post optimal solution.

2 - Emissions Trading
Stream: OR and Environmental Management
Invited session
Chair: Michaela Graf, Mercator School of Management, Chair of Logistics, University Duisburg-Essen, Lotharstr. 65, 47057, Duisburg, Germany, michaela.graf@uni-duisburg-essen.de

1 - Incentives and burden sharing in post-kyoto climate regimes — a cge analysis with the dart model
Sonja Peterson, Kiel Institute for the World Economy, Duesternbrookweg 120, 24105, Kiel, sonja.peterson@ifw-kiel.de, Gernot Klepper
Opportunity Model (ROM) is a widely known method for measuring Revenue Management System. For leg-based controls the Revenue Techniques for Performance Measurement are an integral part of an alliance revenue to the partners in a fair way to ensure the stability of the alliance. We define the problem as a cooperative game and propose the Nucleolus solution as a fair revenue allocation mechanism. We carry out a computational study on randomly generated networks to test the performance of our allocation mechanism.

3 - Performance measurement in airline network revenue management

Christian Temath, Decision Support & Operations Research Lab, University of Paderborn, Mauenheimer Straße 147, 50733, Köln, Germany, Christian.Temath@wiwi.uni-paderborn.de

Techniques for Performance Measurement are an integral part of a Revenue Management System. For leg-based controls the Revenue Opportunity Model (ROM) is a widely known method for measuring Revenue Management performance. However, this traditional ROM does not show valid results for network-based Revenue Management especially with dependent demand structures. We will discuss a network-based ROM for both independent and dependent demand. In this context, we will introduce a method for measuring the robustness of the ROM against influencing factors and present computational results.

2 - Nucleolus based revenue allocation in airline alliances

Demet Cetiner, Mercator School of Management, University of Duisburg-Essen, Lotharstrasse 65 LB 212, 47057, Duisburg, Germany, demet.cetiner@uni-due.de, Alf Kimms

Airline alliances offer many multi-leg itineraries where flight legs are operated by different airlines. Due to the increased number of flight combinations, they can serve more destinations and achieve better revenues. In this paper, we study the problem of allocating the alliance revenue to the partners in a fair way to ensure the stability of the alliance. We define the problem as a cooperative game and propose the Nucleolus solution as a fair revenue allocation mechanism. We carry out a computational study on randomly generated networks to test the performance of our allocation mechanism.

3 - Robust parameter estimation based on Huber estimator in systems of differential equations

Ekaterina Kostina, Department of Mathematics and Computer Science, University of Marburg, Hans-Meerwein-Str., 35032, Marburg, kostina@mathematik.uni-marburg.de

The problem of parameter identification in dynamic models is among the most important tasks in mathematical modeling of dynamic processes. One of the problems in real-life applications is that data contains outliers. Thus, a reliable parameter estimation procedure is necessary that deliver estimates less sensitive to measurement errors. One of the robust parameter estimation is based on the so-called Huber estimator. The talk focuses on the method for robust parameter estimation for dynamic systems. The method is successfully applied to several real-life problems.

4 - Immobile indices in study of convex SIP and SDP problems

Tatiana Tchemisova, Mathematical Department, Aveiro University, Campus Universitário de Santiago, 3810-193, Aveiro, Portugal, tatiana@math.ua.pt, Olga Kostyukova

We introduce notions of immobile indices and immobility orders for Semi-Infinite and Semi Definite Programming. The set of immobile indices is an important characteristic of feasible sets and can be successfully used in optimality conditions without constraint qualifications.

Consider the problem of computing optimal bounds on a functional expected value of a partially known random variable. In contrast to traditional models which impose moment constraints, we show that superior bounds can be achieved by restricting the corresponding density by mass and shape constraints. Our main result provides an important generalization to the case of shape constraints imposed on different parts of the domain. We propose a programming framework based on conic duality theory which enables us, under mild conditions, to reduce the optimization problem to a semidefinite program.

2 - Error bounds property and other types of constraint qualification in perturbed nonlinear programming

Leonid Minchenko, Informatics, Belarus State University of Informatics and Radioelectronics, 7-31 Gorny peretulok, Minsk, Belarus, kostyukova@im.bas-net.by

L.Minchenko, S. Stakhovski

Error Bounds Property in Perturbed Nonlinear Programming

The error bounds property is a constraint qualification closely related to the concept of calmness. The well-known Mangasarian-Fromovitz constraint qualification implies the error bounds property. The aim of our paper is to show that under some conditions for the perturbed nonlinear program the error bounds property is also implied with the constant rank constraint qualification.

2 - Option pricing under mass and shape constraints via semidefinite programming

Geert Wouters, University of Antwerp, Prinsstraat 13, 2900, Antwerp, geert.wouters2@ua.ac.be

Consider the problem of computing optimal bounds on a functional expected value of a partially known random variable. In contrast to traditional models which impose moment constraints, we show that superior bounds can be achieved by restricting the corresponding density by mass and shape constraints. Our main result provides an important generalization to the case of shape constraints imposed on different parts of the domain. We propose a programming framework based on conic duality theory which enables us, under mild conditions, to reduce the optimization problem to a semidefinite program.
We show that under some fairly general and easy to check symme-
trization case where each rm knows its type but not the competitors’
types. Several models have been presented and the agents’ preferences, the sequence of Edgeworthian prices in
the network structure on rms’ prices and profits. We rst analyse
the network structure. The goal is to investigate the effects of
the structure of the network on rms’ prices and profits. We rst analyse
the benchmark case where each rm knows its own degree as well as the rivals’ degree. Then, we also analyse the incomplete infor-
mation case where each rm knows its type but not the competitors’
type.

3 - Extending the hotelling model: incomplete information
and networks
Alberto A. Pinto, Departamento de Matematica,
University of Minho, Escola de Ciencias, Universidade
do Minho, 4710-057, Braga, Portugal,
mpmo@fcna.up.pt, Rosa Esteves, Telmo Parreira

We develop a theoretical framework to study spatial price competi-
tion in a Hotelling-type network game. We investigate price com-
petition à la Hotelling with complete and incomplete information
about the network structure. The goal is to investigate the effects of
the network structure on rms’ prices and profits. We rst analyse
the benchmark case where each rm knows its own degree as well as
the competitors’ degree. Then, we also analyse the incomplete infor-
mation case where each rm knows its type but not the competitors’
type.

4 - Walrasian price in an edgeworthian economy
Bruno M.P. M. Oliveira, FCNAUP, R. Dr. Roberto
Frias, 4200-465, Porto, Portugal, bpmpm@fcna.up.pt,
Barbel Finkenstadt, Alberto A. Pinto, Athanasios
Yannacopoulos

A key problem of economic theory is the convergence of the prices
in a market to their equilibrium values. Several models have been
presented and the agents ’ preferences, the sequence of Edgeworthian prices in
a random matching economy converges to the Walrasian prices for
this economy.

The distance between two vertices represents the length of the shortest
path connecting them. This notion has been used in graphs to
construct the class of distance hereditary graphs which the distance
between any two non adjacent vertices of any connected subgraph
of a connected graph is the same as the distance between these two
vertices in the original graph. By adapting this concept to the bipartite
graphs, Alder introduced the class $B(k, +)$ where the length of the
shortest $u,v$-path of $G$ is at most equal to $d(u,v)+2k$. In this paper,
we study the general case by giving some forbidden subgraphs.

2 - Planar graphs without short cycles OR close triangles
are three-colourable.
Aleksey Glebov, Discrete Analysis and Operations
Research, Sobolev Institute of Mathematics, Prospekt
Koptyuga, 4, 630090, Novosibirsk, Russian
Federation, angle@math.nsc.ru

We present new suficient conditions for a planar graph to be three-
colourable: any planar graph without cycles of length five and with
minimum distance between triangles at least two is three-
colourable; a planar graph where five-cycles have no common edges
with triangles and any two triangles are at distance at least four is
three-colourable; a planar graph where triangles have no common
edges with cycles of length between four and seven is three-
colourable.

3 - Decomposing planar graphs into degenerate sub-
graphs
Dolgor Zambalaeva, Discrete Analysis and Operations
Research, Sobolev Institute of Mathematics, Prospekt
Koptyuga, 4, 630090 Novosibirsk, 630090,
Novosibirsk, Russian Federation, dolgor@ngs.ru,
Aleksey Glebov

The problem of decomposing planar graphs into degenerate sub-
graphs has been actively investigated recently. We present some re-
cent results about decompositions of planar graphs into forests, star
forests and subgraphs with restricted path lengths. For example,
we prove that the vertex set of a planar graph of girth seven can
be partitioned into two subsets each of which induces a star forest.
Another important result is that any planar graph of girth five is tau-
partitionable which partially confirmsthe well-known conjecture by
Frick, Mihok et al.

TE-27
Tuesday 14:30-15:50
GSI - S 21

Integer Programming
Stream: Discrete Optimization
Contributed session
Chair: Sonja Friedrich, Fachbereich Mathematik, TU
Darmstadt, AG Optimierung, Schlossgartenstraße 7, 64289
Darmstadt, Hessen, Germany,
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1 - Mathematical modelling of transition from open pit to underground mining using integer programming
K. Oraee, Stirling University, FK9 4LA, Scotland,
United Kingdom, sko1@stir.ac.uk, Arsalan Rahmani,
Ezeddin Bakhtavar, Kouros Shahzari

Conventionally, there are established surface and Underground (Ug)
methods to mine deposits. Somewhere, it is more suitable to mine
a deposit by combined method of Open Pit (OP) as a common surface
method and Ug. Now, the most important question emerges: where is the Optimum Transition Depth (OTD) from OP to Ug? We
recently, this problem (OTD) is introduced as a major challenge in
mining. In this study, to optimize the problem and modelling, the
0-1 Integer Programming (IP) was employed. Its objective function
was founded upon maximization of total profit of OP and Ug with
related limitations.
The product depends on the competition between the national brands and the retailer's decision in introducing the store brand and selecting a supplier for the retailer. The results underline that the retailer's second-order covers.

How three further types of 0-1 relationships can be used to generate only relatively weak constraints are available. It will also be shown how three further types of 0-1 relationships can be used to generate second-order covers.

Partial reverse search

Sonja Friedrich, Fachbereich Mathematik, TU Darmstadt, AG Optimierung, Schloßgartenstraße 7, 64289, Darmstadt, Hessen, Germany, friedrich@mathematik.tu-darmstadt.de, Lars Schewe

Knowing the structure of vertices of polytopes around optimal solutions is of particular interest. Partial reverse search (prs) is an algorithm which looks for integer vertices in MIPs in a clever way. The implementation uses the lp-solver Clp and is based on the algorithm partial reverse search by David Avis and Komei Fukuda. Whereas reverse search is looking for all vertices, prs is interested in the integer ones. Therefore it can be used to solve 0-1-problems and promises to be useful as heuristic for MIPs. We present some preliminary results of computational examples.

TE-28
Tuesday 14:30-15:50
GSI - S 1

SCM in Retailing
Stream: Demand and Supply in Consumer Goods and Retailing

Invited session
Chair: Waldemar Toporowski, Faculty of Economic Sciences, Georg-August-Universität Goettingen, Platz der Goettinger Sieben 3, 37073, Goettingen, Germany, wttoporo@uni-goettingen.de

1. Analyzing channel structures for the procurement of store brands with a game-theoretic approach
Stephan Zielke, Chair of Retailing, Georg-August-Universität Göttingen, Platz der Göttinger Sieben 3, 37073, Göttingen, Germany, szielke@uni-goettingen.de, Waldemar Toporowski

This paper analyzes different channel structures for the procurement of store brands. In structure 1, the national brand manufacturers produces the store brand, while in structure 2, the store brand is produced by a small (regional) supplier. A game-theoretic model analyzes the economic consequences of these channel structures from a retailer's perspective. The results underline that the retailer's decision in introducing the store brand and selecting a supplier for the product depends on the competition between the national brands in the category.

2. Integrative retail logistics
Michael Sternbeck, Logistics, Catholic University of Eichstätt Ingolstadt, Auf der Schanz 49, 85049, Ingolstadt, michael.sternbeck@ku-eichstaett.de, Heinrich Kuhn

A grocery retail chain generally consists of the three subsystems warehousing, transportation and instore-logistics. In traditional planning approaches the shop itself usually played a minor role. In fact the operating expense in the outlets often is higher than in the upstream activities. In the speech the problems of integrating instore activities are addressed and an integrative approach is discussed.

TE-29
Tuesday 14:30-15:50
GSI - S 2

Commodity Risk Management 2
Stream: Financial Modelling

Invited session
Chair: Rita D’Ecclesia, Teoria Economica e Metodi Quantitativi per le Scelte politiche, Università di Roma, Piazza Aldo Moro 5, 00185, Roma, Italy, rita.decclesia@uniroma1.it

1. Electricity price modelling with a regime-switching volatility
Silvana Musti, Dipartimento di Scienze Economiche, Matematiche e Statistiche, University of Foggia, Largo Papa Giovanni Paolo II, 1, 71100, Foggia, Italy, s.musti@unifg.it, Viviana Fanelli

In this paper we focus on the analysis of the energy prices using a regime switching approach to describe the volatility evolution. The regime switching approach allows to capture the conditional volatility persistence and the jump behaviour of energy prices. We model directly the forward price adopting the Heath-Jarrow-Morton approach from interest rate theory. This approach suggests to directly assume the dynamics of the forward price evolution either in terms of market dynamics or under the risk-neutral measure.
the iterative sensitivity analysis is performed, which gives us more effective balancing of options for energy that other models.

In the paper we propose pricing rule for the stock market in situation of oligopoly. It is developed basing on the Modified Vickrey Double Auction pricing rule (Yoon, 2001) which provides incentives for participants to provide truthful offers. It cannot be applied to stock market, because of differences between the auctions and stock markets. The new pricing rule is based on a parametric analysis of mathematical model (PAM) of the stock market. For every offer, the iterative sensitivity analysis is performed, which gives us individual prices. We analyze properties of the PAM pricing rule.

3 - Stochastically resonating spiking in power markets and its estimation

Carlo Lucheroni, Dept. of Mathematics and Informatics, University of Camerino, via M. delle Carceri 9, 62032, Camerino (MC), Italy, carlo.lucheroni@unicam.it

Recently, a new way to model the irregularly peaking price dynamics of power markets was introduced [1], which uses a system of nonlinear stochastic differential equations and is able to display both sudden narrow spikes of variable height and small day/night oscillations. This system can be calibrated on discrete-time sets of prices using both least squares and maximum likelihood, despite the delicate issue of possible non-stationarity in price series data. [1] C. Lucheroni, Resonating models for the electric power market, Phys. Rev. B. 62, 9831, 2007.

TE-30
Tuesday 14:30-15:50
GSI - S 26

Energy, Oil and Gas 2

Stream: Engineering Optimization
Invited session
Chair: Jose Herskovits, COPPE, Federal University of Rio de Janeiro, Caixa Postal 68503, 21949570, Rio de Janeiro, RJ, Brazil, jose@optimize.uff.br.br
Chair: Bastian Felix, Lehrstuhl für Energiewirtschaft, Universität Essen, Universitätstr. 12, 45117, Essen, Germany, bastian.felix@uni-duisburg-essen.de

1 - Evolution of joint balancing of electric energy, options for energy and transmission rights

Przemysław Kacprzak, Institute of Control & Computation Engineering, Warsaw University of Technology, Świętawida 63/16, 03-144, Warsaw, Poland, P.Kacprzak@elka.pw.edu.pl, Eugeniusz Toczyłowski

In this paper we compare hybrid auction based on multicommodity turnover model with others market-based allocation methods: implicit and explicit auctions. The hybrid models is extension of models proved for Open Market Coupling. This hybrid model combines positive feature of implicit auction: effectiveness and ease of use for standard commodities and explicit auction: possibiblity to create customized deals between offers. In addition this model offers more effective balancing of options for energy that other models.

2 - Optimization applications in natural gas industry

Stefen Rebennack, Industrial and Systems Engineering, University of Florida, 303 Weil Hall, P.O. Box 116955, 32611, Gainesville, Florida, United States, steffen@ufl.edu, Qipeng Phil Zheng, Niko Iliadis, Panos Pardalos

With the surge of the global energy demand, natural gas plays an increasingly important role in global energy market. To meet the demand, optimization techniques have been widely used in the natural gas industry, and yielded a lot of good results. In this chapter, we give a detailed discussion of optimization applications in natural gas industry in three aspects: production, transportation, and market.

TE-31
Tuesday 14:30-15:50
GSI - S 34

Data Mining for Life Sciences
Stream: Optimization and Data Mining
Invited session
Chair: Carlotta Orsenigo, p.zza Leonardo da Vinci 32, 20133, Milan, Italy, carlotta.orsenigo@polimi.it

1 - Optimal selection of protein structure models

Fabio Stella, Department of Information, Systems and Communication, Università degli Studi di Milano Bicocca, Viale sarca 336, U14 Building, 20126, Milan, Italy, stella@disco.unimib.it, Enrico Fagioli, Elena Gatti, Gianluca Negri, Giacomo Tuana, Giacomo Tuana

Protein structure prediction, which aims to predict the 3D structure of proteins, starting from their amino acid sequences, is one of the most complex tasks in bioinformatics. Protein structure prediction is very relevant in medicine (drug design) and biotechnology (design of novel enzymes). This contribution describes a methodology to efficiently explore the class of data mining models known as feedforward networks. The proposed methodology, based on experimental design, allows to select the optimal architecture of feedforward networks to forecast the quality of protein structure models.

2 - New challenges for feature selection in the life sciences

Karsten Borgwardt, Interdepartmental Bioinformatics Group, MPIs Tübingen, Spemannstr. 38, 72076, Tübingen, Germany, karsten.borgwardt@tuebingen.mpg.de

The life sciences create new challenges for feature selection in data mining. First, there is a need for feature selection on structured data such as strings and graphs. Second, a deeper theoretical understanding of the connections between existing feature selection approaches would be beneficial, to explain the discrepancies in their results on the same datasets. Third, the large number of features poses a computational and algorithmic challenge and requires the development of new, efficient selection techniques. In this talk, we will present our work on these three topics.

3 - Kernel methods for imbalanced data

Theodore Trafalis, Industrial Engineering, University of Oklahoma, 202 West Boyd, Rm 124, 73019, Norman, OK, United States, ttrafalis@ou.edu

We address the problem of learning from imbalanced data sets. Specifically we assume that the number of instances in one class is much larger than the number of instances in the other class. Common approaches for dealing with the class imbalance problem is modifying the data distribution or using a biased classifier. Here we investigate the use of kernel methods for imbalanced data and propose a kernel logistic regression method with an intelligent sampling scheme. Computational results for several data sets from the life sciences are presented.
4 - Cancer microarray data classification by discrete svm with nonlinear kernels

Carlo Vercellis, Ingegneria Gestionale, Politecnico di Milano, P.zza Leonardo da Vinci 32, 20133, Milano, Italy, carlo.vercellis@polimi.it, Carlotta Orsenigo

In this paper we consider discrete support vector machines (SVM) based on nonlinear kernels for microarray data classification. The approach consists of a two stage procedure; in the first phase, a small subset of highly discriminant genes is selected by solving a mixed-integer optimization problem. In the second phase, discrete SVM with nonlinear kernels are used in order to label gene expression data. Computational experiments indicate the effectiveness of the proposed method which achieves a high classification accuracy on benchmark microarray datasets for cancer diagnosis.

**TE-32**

**Tuesday 14:30-15:50**

**GSI - S 4**

**DMKD frameworks and systems**

Stream: Data Mining and Knowledge Discovery

**Invited session**

Chair: Ioannis Kopanakis, Technological Educational Institute of Crete, 72200, Ierapetra, Greece, i.kopanakis@emark.teicrete.gr

1 - Learning of adaptation strategies in particle swarm optimization

Tjornen Bogon, Institute of Computer Science, Goethe University Frankfurt, P.O. Box 111932, 60054, Frankfurt, Germany, tbogon@informatik.uni-frankfurt.de, Andreas Lattner, Yann Lorion, Ingo J. Timm

We present an approach to learning adaptation strategies for Particle Swarm Optimization (PSO). The optimization process very much depends on the parameters how to compute the new velocity of the particles. Different settings can lead to a high variety in the duration and quality of the optimization process depending on the fitness function. We apply machine learning techniques to learn successful adaptation strategies by taking into account properties of different situations (e.g., swarm density and average velocity). For evaluation we apply the approach to typical benchmark functions.

2 - Rules-based data warehouse quality framework for data mining

Bradij Louardi, MI, UNIVERSITY OF TEBESSA, Algeria, bradjilouardi@yahoo.fr, Boutiudia Mahmoud

This work uses the data cleaning mechanisms during the DW to improve the quality of OLTP system. The main contributions are: 1-Rule warehousing: a software infrastructure which collect, transform and clean rules by using the first order logic properties in the rule staging area, loading it in a repository. 2-Rules based data cleaning for DW inspired from DM in order to speed the DM process and improvement of DM results. 3-Cleaned feedback: before loading data in DW, the cleaned data will be propagating to the OLTP system in order to ensure the coherency between DW and OLTP system.

3 - Knowledge acquisition for multi-attribute classification problem solving on the basis of the verbal decision analysis

Eugenia Furems, Decision Making, Institute for System Analysis, 9, Prospect of 60 let Octyabrya, 117312, Moscow, furems-em@mtu-net.ru

Strengths and weaknesses of some VDA-based knowledge acquisition techniques for ordinal and/or nominal multi-attribute classification problems are analyzed. A combined approach to knowledge acquisition is proposed using inference of the attributes' values in classes, admissibility of the attributes' values and simulating the dialogue with an expert close to his/her professional activity. Such approach allows both to obtain the complete (up to the expert knowledge) and consistent set of his/her classification rules and to avoid the exhaustive search of the objects to be classified.

**TE-33**

**Tuesday 14:30-15:50**

**GSI - S 7**

**Linear Programming**

Stream: Linear Optimization

**Contributed session**

Chair: Apostolos Panagiotopoulos, Business School, Nottingham University, Jubilee Campus, Wollaton Road, NG8 1BB, Nottingham, United Kingdom, lixap14@nottingham.ac.uk

1 - Least norm solution to large-scale linear programming problems

Parvin Khorasavi, Mathematics, Shahed University, Department of Mathematics, Shahed University, Tehran, Iran, 1417953836, Tehran, Tehran, Iran, Islamic Republic Of, parvin_khorasavi@yahoo.com, Hamid Reza Navidi, Alaeedin Malek

The aim of this paper is to find an exact least 2-norm solution to a primal problem and generate an exact solution to the dual problem. The algorithm can solve linear problems with 1000000 of variables and 100 of constraints. We use generalized Newton method and strong Wolf conditions. The algorithm converges to the optimal solution independent of the starting point. There are some problems that without using strong Wolf conditions cannot be solved. We give encouraging comparative test results with MATLAB on a class of generated large-scale linear problem.

2 - Systematic construction of examples for cycling in the simplex method

Peter Zörnig, Statistics, University of Brasilia, Asa Norte, 70910-900, Brasilia, DF, peter@unb.br

In Linear Programming the problem of cycling of Dantzig’s simplex method has been captivating the spirits of mathematicians. Almost all ‘simplex type’ algorithms involve the possibility of cycling (or stalling). However, until recently only a “handful” of cycling examples could be found in the literature. We develop systematic procedures to construct such examples for diverse variants of pivot selection strategies. Constructed cycling examples may serve as test problems to evaluate the practical performance of anticycling procedures or new variants of simplex type methods.

3 - Optimising autoregressive based forecasts through linear programming

Apostolos Panagiotopoulos, Business School, Nottingham University, Jubilee Campus, Wollaton Road, NG8 1BB, Nottingham, United Kingdom, lixap14@nottingham.ac.uk, Luc Muyldermans
We explore the use of Linear Programming (LP) as an alternative tool to develop and optimise autoregressive based forecasting models. We estimate the coefficients of several models by minimising the Mean Absolute Deviation or the Mean Absolute Percentage Error. The models are tested on 60 randomly selected time series from the M3 Competition. We compare the forecast accuracy of the LP-based approaches, the Ordinary Least Squares method (minimising the Mean Squared Error) and six other traditional forecasting techniques.

In adversarial systems, the performance of a classifier decreases after it is deployed, as the adversary learns to defeat it. Recently, adversarial data mining was introduced as a solution to this, where the classification problem is viewed as an adversary versus classifier game. In this domain, using games of incomplete information, a game theoretic data mining framework is proposed in order to build an adversary aware classifier. Experiments in a phishing fraud detection domain show that the proposed framework outperforms incremental classification algorithms in this adversarial environment.

4 - An application of econometric and fuzzy clustering methods to the it coalescence between selected industries

Georg Peters, Department of Computer Science and Mathematics, University of Applied Sciences - München, Lothstrasse 34, 80335, Munich, georg.peters@cs.lmu.edu, Simon Poon

The impacts of the evolving IT on organizations and industries have been researched intensively. With the increasing availability of panel data it is now possible to study its longer term effects and its role in industry coalescence and the reshaping of industry boundaries. This study develops a concept of industry coalescence by examining the effects of IT on industry profiles and the shifting industry boundaries over more than two decades. In our research we utilize both the fixed effects model and fuzzy clustering and show the suitability of these methods for our economic analysis.

2 - Portfolio selection under a set of risk measures: the case of var and cvar

Eva Alfaro-Cid, Instituto Tecnológico de Informática, Camino de Vera, S/N, 46022, Valencia, evalfar@iti.upv.es, J. Samuel Baixauli, Matilde O. Fernández-Blanco

This paper empirically investigates the diversification effects to a traditional portfolio of stocks and bonds by introducing alternative investments (hedge funds, managed futures, real estate, private equities and commodities). This paper is the first attempt to incorporate a variety of risk measures (Volatility, VaR, CVaR, mVaR and mCVaR) as a goal function for the portfolio optimization and different estimates for the expected return (historical estimates, CAPM estimates, robust Bayes/Stein estimates and the Black/Litterman Model).
This paper is concerned with asset allocation under real constraints, using a set of two widely used risk measures, which are the Value at Risk and the Conditional Value at Risk. Our main contributions are that we consider two risk measures which lead to non-convex problem and we introduce real constraints. The approach we propose is based on multi-objective genetic algorithms. Our results show the adequacy of the multi-objective approach for the portfolio optimization problem and emphasize the importance of dealing with real constraints during the optimization process.

3 - Risk measures respecting comparative risk aversion

Klaas Schulze, Department of Economics, University of Bonn, Thielstr. 2, 53113, Bonn, Germany, klaas.schulze@uni-bonn.de

Decisions involving uncertainty depend on two distinct aspects: the risk of the position and the attitude towards risk of the investor. The literature captures the first aspect by risk measures and the second by risk aversion. We connect both concepts by introducing the class of risk measures which respect comparative risk aversion. The connection is achieved by an axiom, which asserts that less risk averse agents accept riskier gambles. We characterize this class by a simple equivalent condition. This equivalence provides a representation theorem and a construction method for this class.

1 - Dynamic reliability under preventive maintenance: application to mv/lv power transformers.

Medjoudj Rahab, Electrical engineering, University of Bejaia, University of Bejaia, 06000, Bejaia, Algeria, medjoudj@yahoo.fr, Djamil Assiani

The purpose of this paper is to investigate the expected performances of MV/LV power transformers of an electrical distribution system. Depending on threshold reliability and maximum benefit, maintenance actions are developed and applied for performances improvement. Performances are described in terms of failure rates, outage times and availability. The modelling is based on the Weibull-Markov approach. In practical operation, the results analysis allows to the decision maker to reach better information for practicing suitable maintenance actions.

2 - Recursive estimation of the parameters of a parch model

Abida Kerdali, INPS, Institut National de la Planification et de la Statistique, 11 rue Doudou Mokhtar, Ben Aknoun, 16000, Algiers, akerdali@yahoo.fr

We consider on-line estimation methods for PARCH models where data are gradually available in time. These methods help to compute recursively an estimator of the parameters of the model. First, we present a new off-line and not recursive method that requires the inversion of a big size matrix. In the second steep, we improve this method for the on-line estimation that does not require the inversion of the cited matrix; however, some precautions should be taken because recursive methods are very sensitive to the initial values. All methods are presented with numerical experimentations

3 - Maximum number of blocked terminals and number of collisions in p-persistent csma/cd protocols

Antonio Gomez-Corral, Department of Statistics and OR, Complutense University of Madrid, Faculty of Mathematics, Plaza de Ciencias, 3, 28040, Madrid, antonio.gomez@mat.ucm.es

We present the number of collisions as a performance descriptor of practical relevance in CSMA/CD (carrier sense multiple access with collision detection) protocols. We introduce a suitable Markovian framework defined from a discrete-time batch Markovian arrival process and phase-type distributional assumptions for packet transmission and collision resolution times. The embedded Markov chain at slot boundaries can be seen as a level-dependent Markov chain of M/G/1-type. Based on the time to reach the maximum number of blocked terminals, we derive the distribution of the number of collisions.

Multi-Criteria Decision Aids - 3

Stream: Decision Analysis

Contributed session

Chair: Boris Yatsalo, Information Systems, Obninsk State University (IATE), IATE, Studgorodok 1, 249040, Obninsk, Russian Federation, yatsalo@obninsk.ru

1 - A multiple criteria sorting methodology with multiple classification criteria and an application to country risk evaluation

Aydin Ulucan, Dept. of Business Administration, Hacettepe University, Beytepe Campus, 06532, Ankara, aulucan@hacettepe.edu.tr, Kazim Baris Atici

UTADIS (Utilities Additives Discriminates) methodology requires a predefined classification for a set of alternatives obtained through a classification criterion. However, some real world decisions may require consideration of more than one classification criteria. We propose an extension of UTADIS such that it can handle more than one classification criteria simultaneously which possibly involves different predefined classes for alternatives in an application to country risk evaluation. Moreover, we test the classification ability of UTADIS using the out-of-classification criterion approach.

2 - The use of design research in the validation qualitative in operational research

William Vianna, Production Engineering, Federal University of Santa Catarina, Rua Cônego Bernardo, 100, Ap. 202, 88036570, Florianopolis, Santa Catarina, Brazil, wpwilliam@hotmail.com, Leonardo Ensllin, Edilson Gilhorn

The objective is to propose the use of Design Research to encourage the process of scientific validation of qual-quantitative models in Operations Research. The result is the identification of the need for evidencing and discussion around the Design Research on internal and external criteria for validation, alignment between the methodologies and techniques qualitative and quantitative, surveillance on the compliance issue and usability of the models. Finally, it is concluded on the importance of training as a researcher’s primary strategic and the process of production of knowledge.

3 - Decision support for detection of unauthorized genetically modified organisms in food and feed products

Marko Bohanec, Department of Knowledge Technologies, Jozef Stefan Institute, Jamova 39,
In this talk, we will concentrate on the relations between the global quadratic growth condition and the global second-order sufficient condition for mathematical programming problems. In case of minimizing the maximum of finite quadratic functions, we have obtained that the global second-order sufficient condition implies the global quadratic growth condition. Then we apply this result to the quadratic constrained quadratic programs. However, the converse is not true except for the unconstrained problems.

3 - Penalty versus filter methods

Aldina Correia, Mathematics, Escola Superior de Tecnologia e Gestão de Felgueiras - Instituto Politécnico do Porto and Centro de Matemática da UTAD (CM-UTAD), Rua do Curral, Casa do Curral, Margaride, 4610-156, Felgueiras, Portugal, aldinasabel@gmail.com, João Matias, Pedro Mestre, Carlos Serôdio

Black box problems occur frequently in science and engineering. In those cases it becomes essential to use optimization methods where the calculation of the derivatives, or the verification of their existence, is not necessary the Direct Search Methods. But, when the problem has constraints, they are not enough, because they only solve Unconstrained Nonlinear Problems. This kind of problems is usually solved using Penalty or Filter Methods. In this work we compare the behavior of some of the existing Penalty and Filter Methods.

4 - Weak sharp minima for set-valued vector variational inequalities with an application

Xiaoqi Yang, Department of Applied Mathematics, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, mayangxq@polyu.edu.hk

Gap functions for vector variational inequalities are studied. Relations between set-valued strong/weak vector variational inequality problems is established. Moreover, it is shown that weak sharp minima properties for the solution sets of set-valued strong/weak vector variational inequality problems hold in terms of gap functions. As an application, the weak efficient solution set of vector optimization problems is proved to be weak sharp minimum. This is a joint work with J. Li and N.J. Huang and was supported by RGC (PolyU 5317/07E).

In Theorem 2.5 of [Marcin Studniarski and Doug E. Ward, SIAM J. Control Optim. 38 (1999), no. 1, 219–236], a sufficient condition was derived in terms of a contingent-type directional derivative for weak sharp minima or equivalently local error boundness. The purpose of this talk is to extend Studniarski and Ward’s condition in a unified and natural way, and to look into some conditions related to variational geometry of the given set, under which the proposed sufficient conditions are also necessary for local error boundness. Moreover, some interesting examples are demonstrated.

2 - On the equivalence of global quadratic growth condition and second-order sufficient condition

Zhangyou Chen, Department of Applied Mathematics, The Hong Kong Polytechnic University, Hunghom,Kowloon, Hong Kong, Hong Kong, China, 07901401r@polyu.edu.hk

Nonlinear Optimization

Stream: Variational Problems - Theory, Methods and Applications

Invited session

Chair: Kaiwen Meng, Department of Applied Mathematics, PolyU, Kowloon, Hong Kong, China, mkwfly@126.com

1 - On characterizations of local error bounds by derivative-like conditions

Kaiwen Meng, Department of Applied Mathematics, PolyU, Kowloon, Hong Kong, China, mkwfly@126.com

In Theorem 2.5 of [Marcin Studniarski and Doug E. Ward, SIAM J. Control Optim. 38 (1999), no. 1, 219–236], a sufficient condition was derived in terms of a contingent-type directional derivative for weak sharp minima or equivalently local error boundness. The purpose of this talk is to extend Studniarski and Ward’s condition in a unified and natural way, and to look into some conditions related to variational geometry of the given set, under which the proposed sufficient conditions are also necessary for local error boundness. Moreover, some interesting examples are demonstrated.

2 - On the equivalence of global quadratic growth condition and second-order sufficient condition

Zhangyou Chen, Department of Applied Mathematics, The Hong Kong Polytechnic University, Hunghom,Kowloon, Hong Kong, Hong Kong, China, 07901401r@polyu.edu.hk

1 - Endogenous risk factors for discontinuous financial markets

Giorgio Consigli, Mathematics, Statistics and Computer Sciences, University of Bergamo, Via dei Caniana 2, 24127, Bergamo, Italy, giorgio.consigli@unibg.it

In this talk, we present a decision-support approach to the problem of potential presence of unauthorized genetically modified organisms (GMOs) in food/feed products. The issue is to assess the likelihood of admixture with unauthorized GMO varieties using the product’s traceability data: origin, transportation, logistics. We approached the problem by developing two decision models, a decision tree and a hierarchical multi-criteria model, implemented as a web application within the system DEXi. We compare them with respect to their ability data: origin, transportation, logistics. We approached the problem by developing two decision models, a decision tree and a hierarchical multi-criteria model, implemented as a web application within the system DEXi. We compare them with respect to their properties, implementation and suitability for the problem.
The distribution of securities prices in financial markets is known to exhibit heavy tails, and furthermore the time trajectory has occasional extreme swings or reversals in direction. The modeling of heavy tails has been achieved with the addition of a homogeneous point process to a diffusive process. In this paper a non-homogeneous point process is introduced, so that the intensity and size of jumps are state dependent. The study is conducted over the 1990-2007 period in the US market.

2 - Scenario models for dynamic optimization during crises periods

Gaetano Iaquinta, University of Bergamo, 24127, Bergamo, Italy, gaetano.iaquinta@unibg.it, Giorgio Consiglio

A scenario generation procedure to be interfaced with a dynamic stochastic program developed for a credit risk problem is presented and applied to the recent credit crisis. The statistical models considered in the approximation procedure are a Garch(1,1) process and a jump-to-default model for credit risk factors. Evidence of the ability to approximate a fat-tailed market probability distribution is presented.

3 - The role of options in hedging portfolios in regimes of high volatility

Francesco Sandrini, Institutional investments, Pioneer Investments, 16 Appianstrasse, Unterforthing, bei Munchen, 81675, Munchen, Germany, francesco.sandrini@pioneerinvestments.com

We investigate the role of derivatives in hedging total return portfolios in times of high volatility. The sensitivity of the hedging solution with respect to volatility regime changes is investigated by comparing hedging results under constant volatility assumptions with Heteroscedastic models such as Garch DCC employing stochastic programming techniques to achieve a realistic pay-off under stressed market conditions.

This article describes inventory optimization for products with stochastic lead time and demand. For simulation purpose mathematical tool Matlab and C# were compared. The basic system dynamics model for inventory control was built and validated according to system dynamics methodology. Several optimization algorithms were analyzed in order to reduce total inventory control costs. Two restrictions were considered: no stockouts should occur and the inventory capacity should not be exceeded. Web based solution has been introduced for predictive validation of algorithms in the real environment.

2 - Job shop scheduling production with makespan criterion - a real case simulation study

Davorin Kofjač, Laboratory of Cybernetics and DSS, University of Maribor, Faculty of Organizational Sciences, Kidričeva cesta 55a, 4000, Kranj, Slovenia, davorin.kofjac@fov.uni-mb.si, Miroljub Kljačic, Andrej Knaflic

This paper presents a real case customized flexible furniture production optimization. Frequent review of the production process is needed to ensure near-optimal production schedule to meet the minimal makespan constraint. In such a case we are confronted with a tradeoff between makespan and optimization runtime to ensure efficient realtime scheduling. The genetic algorithm for job shop scheduling optimization is presented. The visual model of the furniture production was developed. Such a model is closer to end-user perception and is used to clarify the results of numerical optimization.

3 - Applying system dynamics to design scenarios and the strategy of a region using quantitative and qualitative information

Carlos Legna, Institutional Economics, La Laguna University, Universidad de La Laguna, Facultad de Derecho, 38071, La Laguna, Canary Islands, Spain, clegna@ull.es

The design of strategies for social systems requires the use of quantitative information; in addition, the information that the specialists and the decision makers often obtain is incomplete and unsure. Nevertheless, the leaders have to make strategic decisions despite these deficiencies. The author has been working—with decision makers—in the design of tools to help them to improve their decisions in these conditions. An example is the methodology elaborated to design the strategy for the city of Santa Cruz, which is presented in this paper.
This paper considers a new lower bound for the RCPSP with resource constraints and objective the minimization of the makespan. The bound is an extension of Stinson’s lower bound, where instead of using a non-critical activity together with the critical path, a second full path consisting of non-activities is executed simultaneously with the critical path. By using some powerful dominance rules a very efficient algorithm is developed where the number of schedules reviewed from the huge potential combinatorial set is minimized getting a lower bound much better than that of Stinson.

2 - Evaluation and comparison of the relative performance of projects using Weibull analysis on earned value metrics

Ching Chih Tseng, Business Administration, Dayeh University, 168 University Rd., Dacon, Taiwan, R.O.C., 51591, Changhua, Taiwan, cctseng@mail.dyu.edu.tw

Many literatures have proposed assessment the performance of a project; however few of them consider the issue of comparison of relative performance of projects. A major concern for a multi-project organization is how to assess and compare them. Therefore, this paper introduces a statistical analysis for evaluating and comparing the reliability of relative overall performance of projects using Weibull analysis on earned value metrics. Finally, the various steps in the analysis are discussed along with an example in which three projects are analyzed and compared.

3 - A lagrangean heuristic to the capacitated planned maintenance problem

Torben Kuschel, WINFOR - Wirtschaftsinformatik und Operations Research, Bergische Universität Wuppertal, Schumpeter School of Business and Economics, Gaulstraße 20, 42119, Wuppertal, Germany, tkuschel@winfor.de, Stefan Bock

The Capacitated Planned Maintenance Problem seeks a maintenance plan guaranteeing the machine does not break down and the maintenance time is not exceeded. The Lagrangean relaxation of the capacity constraint is NP-hard and the complementary slackness is applied to the dual of the Lagrangean LP-relaxation to construct an upper bound. It yields valid subgradients to the Lagrangean dual and the lower bound is used for the step size estimation. This differs from many approaches in literature. A feasible solution to the CPMMP is obtained. Valuable insights to the problem structure are provided.

4 - Resource leveling with activity splitting

S. Hossein Hashemi Doulabi, Industrial Engineering, Amirkabir University of technology, Shariati st, North west, side of sadr, no 1, 19148, Tehran, Tehran, Iran, Islamic Republic Of, hosein.hashemi@yahoo.com, Abbas Seifi

The resource leveling problem is common and has been studied numerous times. A basic assumption in these studies is that activities cannot be split. However, real projects very often we can find some non-continuous activities. In this paper, a novel genetic algorithm is proposed to tackle the resource leveling problem with activity splitting. To evaluate the algorithm, we establish an experimental benchmark including instances up to 250 activities. The algorithm’s results are compared with lower bounds in the literature. All the analyses demonstrate that the proposed algorithm is effective.
1 - Laws as models: demobilization and congestion in Colombia's justice and peace process

Laura Pardo, Cra 1 # 110-12, 0000, Bogota, l.pardo139@unianandes.edu.co, Camilo Olaya

Colombian government began a negotiation process with the "paramilitaries": a special Law was created to proceed with demobilization. A growing population of 31,000 men has entered this process but none of them have been sentenced; the system is stuck with unresolved cases. We built a SD model that shows the inertia of accumulation of these cases, the elusive character of Stock-and-Flow structures, and the impact of information delays. We highlight the significance of simulation for supporting Law making processes. We are testing the model for presenting our results to involved agencies.

2 - A system dynamics model to aid planning and allocation of health resources: a case of prevention and treatment of malaria in Uganda

Stephen Tumutegyereize, Institute of Statistics and Applied Economics, Makerere University, P.O.Box 7062, Kampala, 256, Kampala, Uganda, tumutegyereize@yahoo.com, Theodor Stewart, Juma Nyirenda, Leanne Scott

In this paper we show that a System Dynamics model for malaria helps to allocate available budget for prevention, treatment, human resource and infrastructure development to alternatives leading to highest number of averted infections and deaths. The model suits developing countries characterized with hard decisions for choosing interventions, priorities, and allocating resources due to health sector under funding, shortage of health workers, high disease burden, and lack of reliable data to guide planning.

3 - Economic growth accounting: model-based policy analysis

John Ansah, system dynamics, university of bergen, fantoft studentboligler, 5075, bergen, pastorkobina@yahoo.com, Stefan Grosser

The GDP growth pattern of Ghana from 1960 to 2000 shows a roller-coaster behavior. This phenomenon has been studied by several researches. We want to offer a richer explanation. Our model accounts for human and physical capital and the productivity of labor as well as their dynamic interactions. We are (1) able to replicate the historical GDP growth, (2) use the model to estimate the contribution of factors of production and labor productivity to economic growth, (3) offer a consistent causal explanation about the growth pattern, and (4) conduct a counterfactual policy analysis.

4 - The chaotic behavior of prices in the modified Kaldor model

Jan Kodera, Center for Basic Research in Dynamic Economics and Econometrics, University of Economics Prague, nam. Winstona Churchilla 4, 130 67, Praha 3, Czech Republic, kodera@vse.cz, Quang Van Tran, Miloslav Vosvrda

The model of price dynamics is analyzed. The approach presented in this contribution is based on the works of Goodwin, Kaldor and Kalecki which were developed by Flaschel, Semmler and Medio. The aims of this paper are to design an example, solve it and test if the variables dynamics is chaotic. While the flow variables in the model are intensities, in the real economics they are measured as interval quantities. Therefore, we try to find the answer to the question if the observed economic variables recorded in these regular intervals capture the actual dynamics produced by the model.
In this paper we will present in detail the structure and work process of EthXpert - a computer system for supporting ethical decision-making. Based on case studies with students, we will also discuss the level of experience in handling ethical problems that is required to make proper use of the system in real-life decision-making. Finally we will suggest how the resulting documentation of ethical implications can serve as justification for decision-making.

We will show how the tool can be used to reach a better-structured and more holistic overview of moral issues facing the bidder. For blood platelets, which have a limited shelf life (e.g. 5 days), both shortages and outdated blood are to be minimized. Recent European studies (2005, 2006) report an average outdated of 15%. So far, an OR implementation seemed hampered by: i) The computational complexity ii) The structure of the optimal policy iii) Blood Medicine being unfamiliar with OR. To deal with i) and ii), a 5-step integration of Stochastic Dynamic Programming (SDP) and Simulation has been developed. Case-studies for two Dutch Blood Banks showed a reduction of shortages and outdated to less than 1%. Also the issuing age was reduced. As for iii), a user-friendly DSS-tool TIMO (Thrombocytes Inventory Management Optimizer) has been implemented.

Motivated by the increasing use of auctions by government agencies, we consider the problem of fairly pricing public goods in a combinatorial auction. A well-known problem with the incentive-compatible Vickrey-Clarke-Groves (VCG) auction mechanism is that the resulting prices may not be in the core. Loosely speaking, this means the payments of the winners could be so low, that there are bidders who would have been willing to pay more than the payments of the winning bidders. Clearly, this "unfair" outcome is unacceptable for a public sector auction. Recent advances in auction theory suggest that combinatorial auctions resulting in efficient outcomes and bidder-Pareto-optimal core payments offer a viable practical alternative to address this problem. This paper confronts two critical issues facing the bidder-Pareto-optimal core payment. First, motivated to minimize a bidder’s ability to benefit through strategic manipulation (through collusive agreement or unilateral action), we demonstrate the strength of a mechanism that minimizes total payments among all such auction outcomes, narrowing the previously broad solution concept. Second, we address the computational difficulties of achieving these outcomes with a constraint-generation approach, promising to broaden the range of applications for which bidder-Pareto-optimal core pricing achieves a comfortably rapid solution.

Alessandro Mascis
Carlo Mannino, Informatica e Systemistica, Universita’ La Sapienza, Via Bonarroti 12., 00185, Rome, Italy, mannino@dis.uniroma1.it, Alessandro Mascis
Train movements across railway stations are in general still operated by human dispatchers. In order to increase traffic performances and save on operating costs, Azienda Trasporti Milanesi, the largest Italian Municipal transport company, decided to implement a fully automated traffic control system. The task was assigned to Bombardier Transportation, a major multinational company who established a cooperation with the university of Rome. The task posed severe modelling and algorithmic difficulties, and indeed former attempts substantially failed. The model needed to be very accurate to represent real-time decisions; the algorithm had to find good, possibly optimal solutions in less than 1 second. Optimality was nearly a strict requirement as, by contractual clause, the system had to perform better than dispatchers, and heuristic approaches tend sometimes to neglect solutions that are easily achievable by human operators.

We model the problem as a sequence of routing and job-shop scheduling sub-problems and solve it by branch-and-bound. To tackle the job-shop scheduling problem we exploited the properties of a generalized disjunctive graph and developed a fast and tight lower bound procedure by solving a circulation problem on a suitable, small network. The system was put into operation in june 2007 and to our opinion it must be regarded as a remarkable success of OR application to real-life problems.

**TF-02**

Tuesday 16:05-17:25

Schumann

**Collaborative Transportation Planning I**

Stream: Transportation Planning

*Invited session*

Chair: Giselher Pankratz, Dept. of Information Systems, FernUniversität - University of Hagen, Profilstrasse 8, 58084, Hagen, Germany, giselher.pankratz@fernuni-hagen.de

1 - Transport operations planning within a cooperation of complementary producers

Andrea Nagel, Dept. of Information Systems, FernUniversität - University of Hagen, 58084, Hagen, Germany, andrea.nagel@fernuni-hagen.de; Giselher Pankratz, Hermann Gehring

In this contribution, we examine a cooperation of four producers in the food and beverages industry. The companies decided to coordinate their distribution activities by inter-organisational transportation planning. The setting is characterized by a dynamic inflow of orders, capacity bounds, a heterogeneous vehicle fleet and back-hauls. We present a meta-heuristic approach for the simultaneous planning of own-name transport and subcontracting that deals with this specific situation by combining a Large Neighbourhood Search with a Threshold Accepting Procedure. Test results will be presented.

2 - Market-based request re-allocation in collaborative transportation networks

Melanie Blos, Chair of Logistics, Bremen University - Department of Business and Economics, Wilhelm Herbst Str.5, 28359, Bremen, Germany, blos@uni-bremen.de; Herbert Kopfer

Operational transport collaborations are formed by independent hauliers in order to increase the vehicle utilization of each participant. Transport orders are interchanged among the participants in order to enable each participant to compile profitable routes from compatible requests. We discuss a model for the operational transport order re-allocation in a collaboration using market mechanisms. In this market, bundles of available orders are created from individually acquired orders and the bundles are traded. No central institution for hosting the order interchange mechanism is required.

3 - Ant colony algorithms to solve multi depot vehicle routing problems with interim storages

Ralf Sprenger, Chair of Enterprise-wide Software Systems, University of Hagen, 58097, Hagen, Germany, Ralf.Sprenger@fernuni-hagen.de; Lars Moench

We discuss multi depot vehicle routing problems with interim storages that appear in cooperative transportation planning scenarios where different companies share their distribution network. Each company has one or more distribution centers that work for the other companies as interim storages. We present a method that applies ant colony optimization (ACO) to solve this type of problem. We demonstrate the benefit of using ACO in a rolling horizon setting. Discrete-event simulation is used to assess the performance of the suggested scheme. We present results of computational experiments.

**TF-03**

Tuesday 16:05-17:25

Reger

**Network design 1**

Stream: Network Optimization

*Invited session*

Chair: Bernard Fortz, Département d’Informatique, Université Libre de Bruxelles, CP 210/01, Bld du Triomphe, 1050, Bruxelles, Belgium, bfortz@ulb.ac.be

1 - Properties of a layered extended graph formulation for designing k-edge(arc) disjoint l-paths

Quentin Botton, Louvain School of Management - CORE, Université catholique de Louvain, place des doyens,1, 1348, Louvain-la-Neuve, Belgium,quentin.botton@uclouvain.be; Bernard Fortz, Luis Gouveia

In this paper, we propose an extended formulation for the K-Arc(Edge)-Disjoint Hop-Constrained Network Design Problem in the single commodity case. We formulate some interesting properties and we prove that our formulation provides a complete description of the polyhedron when L<=3 and for any value of K for the Arc-Disjoint case. We propose some new valid inequalities for the Edge-Disjoint case and we illustrate the quality of the lower bound when L>3 through some numerical results.

2 - Networks with unicyclic connected components

Walid Ben-ameur, Institut Telecom, 9 rue charles fourier, 91011, evry, france, wald.benameur@it-sudparis.eu; Adam Ouorou, Makhlof Hadji

This paper focuses on the design of networks with unicyclic connected components. The size of each cycle should not be less than a given number. A polyhedral study is proposed. Many facets and valid inequalities are derived. Some of them can be exactly separated in polynomial time. Then the network design problem is solved by a cutting plane algorithm based on these inequalities and using a compact formulation issued from the transversality of the bicircular matroid.

3 - The cost constrained minimum label spanning tree and label constrained minimum spanning tree problems

Zahra Naji Azimi, Viale risorgimento 2, 40136, Bologna, Italy, zahra.najiAzimi2@unibo.it; Majid Salehi, Bruce Golden, S. Raghavan, Paolo Toth
Given an undirected graph whose edges are labeled or colored and have weights, and a budget B, the goal is to find a spanning tree that uses the minimum number of labels while ensuring its cost does not exceed B. In the Label Constrained Minimum Spanning Tree Problem (LCMST), we are given a threshold K on the number of labels. The goal is to find a minimum weight spanning tree that uses at most K distinct labels. In this paper, we present a Variable Neighborhood Search algorithm for the CCMLST and LCMST problems.

**TF-04**
Tuesday 16:05-17:25

**Liszth**

**Scheduling and Lotsizing**

Stream: Scheduling

*Invited session*

Chair: Waldemar Kaczmarczyk, Department of Operations Research & Information Technology, AGH University of Science & Technology, ul. Gramatyka 10, 30-067, Krakow, Poland, waldek@agh.edu.pl

1. **A new algorithm with shifting representation for hybrid flowline problems**

Thijs Urlings, Instituto Tecnológico de Informática, Universidad Politécnica de Valencia, Camino de Vera s/n, 46022, Valencia, Spain, thijs@iti.es, Ruben Ruiz

This work considers the hybrid flowline problem with a set of restrictions and generalisations that are common in practice. We introduce a novel algorithm that starts with an iterated greedy algorithm applied to a job permutation and at a given time switches to an iterated local search on the full search space. To the best of our knowledge, this shift of the solution representation is new in scheduling literature. Experimental results prove the superiority of the algorithm compared to the state-of-the-art, which indicates a breakthrough for scheduling problems with more than one problem aspect.

2. **A dynamic lot size model with two shipping modes**

Hiroyuki Wakinaga, Graduate School of Mathematical Science and Information Engineering, Nanzan University, 27 Seirei-cho, Seto-shi, Aichi, Japan, 489-0863, Seto, Japan, hwakkin@nifty.com, Katsushige Sawaki

In this study, we extend a dynamic lot size model to the case ofcorporating shipping schedule into the model. The shipping consists of two modes. The shipping options are a full container load with fixed cost, a less than container load with a constant cost per unit, or using a combination of both modes simultaneously. The purpose of this study is to present an optimal production scheduling with two shipping modes so as to minimize the total cost over the finite planning horizon when the demands are deterministic.

3. **Scheduling of common setup resources in dynamic multi-machine lotsizing models**

Christian M. Steffens, Seminar für SCM und Produktion, Universität zu Köln, Albertus-Magnus-Platz, 50923, Köln, NRW, Germany, christian.steffens@uni-koeln.de

In this presentation, we extend PLSP-based lotsizing and scheduling models which explicitly include the simultaneous consideration of common setup operators. Especially, parallel machines and sequence-dependent setup operations will be introduced. The performance of heuristic solution approaches will be compared to optimal solutions generated using CPLEX. We show that our heuristic is able to generate near-optimal solutions very fast, even for real-world-sized cases.

4. **Proportional lot sizing and scheduling problem with identical parallel machines**

Waldemar Kaczmarczyk, Department of Operations Research & Information Technology, AGH University of Science & Technology, ul. Gramatyka 10, 30-067, Krakow, Poland, waldek@agh.edu.pl

Proposed paper addresses mixed integer programming models of the lot-sizing and scheduling problems for several products on identical parallel machines with limited capacity. Proposed new model extends so-called proportional model (PLSP) which allows processing of two products in single period on the same machine. In proposed model, thanks to explicit modeling of processing times before and after changeovers, binary variables have been replaced by integer variables. Such aggregation of decision variables makes the model much easier to solve with standard MIP methods.

**TF-05**
Tuesday 16:05-17:25

**Haydn**

**Bioinformatics VI**

Stream: Computational Biology, Bioinformatics and Medicine

*Invited session*

Chair: Jacek Blazewicz, Instytut Informatyki, Politechnika Poznanska, ul. Piotrowo 2, 60-965, Poznan, Poland, jblazewicz@cs.put.poznan.pl

Chair: Marta Szachniuk, Institute of Bioorganic Chemistry, PAS, Koszkowskiego 12/14, 61-704, Poznan, Poland, Marta.Szachniuk@cs.put.poznan.pl

1. **Multiple sequence alignment for a small number of sequences: general method for improving the quality.**

Pawel Wojciechowski, Poznan University of Technology, 60-965, Poznan, Poland, pwojciechowski@cs.put.poznan.pl, Piotr Formanowicz, Jacek Blazewicz

Analysis of the quality of multiple sequence alignment shows that it depends on the number of sequences. The relatively worst results are obtained where the number of sequences in the input set is small. We proposed a general method for improving the quality of alignment for those cases. Our method relies on adding some sequences to the input set before creation of alignment and removing them after. Such an approach is independent of method solving an alignment problem. We have checked what kind of sequences should be added. The method have been evaluated for several alignment databases.

2. **Doman2 — approach for predicting domains boundaries in proteins**

Maciej Antczak, Institute of Computing Science, Faculty of Computer Science and Management, Poznan University of Technology, ul. Piotrowo 2, 60-965, Poznan, Wielkopolska, Poland, mantczak@cs.put.poznan.pl, Maciej Mileston, Piotr Lukasiak
The new method of domains boundaries prediction called DomAn2 has been proposed. Techniques of OR were introduced in the protein analysis area to support biologists. The definition of a domain is not always straightforward. The DomAn2 approach predicts protein domains based on domain boundaries sequence patterns and tries to follow designed decision tree to give a final decision about localization of domain boundary in protein chain. Based on the data from CASP8 accuracy of prediction is on the level higher than 70%. Proposed approach can be successfully applied for the considered problem.

3 - Algorithmic aspects of the RNA degradation process

Agnieszka Rybarczyk, Poznan University of Technology, 60-965, Poznan, Poland, arybarczyk@cs.put.poznan.pl, Jacek Blazewicz

Chemical instability of individual phosphodiester bonds is important in the processing of RNA particles and reflects the autocatalytic properties of this class of nucleic acids. It can possibly play a noticeable role in regulation of RNA stability in vivo. The mechanism of selective hydrolysis was deeply investigated and it was found, that it is sequence and structure dependent. In this study we present a formulation of a new problem of nonenzymatic RNA degradation and an algorithm for finding the solution of the problem. We also show laboratory results.

4 - Parallel computing in DNA assembly

Piotr Gawron, Institute of Computing Science, Poznan University of Technology, ul. Fiotrowo 2, 60-965, Poznan, piotr.gawron@cs.put.poznan.pl

New approaches to DNA sequencing provide much more data in shorter time. Thus there is need to find solutions, which can handle with the input data quickly. There are two possible solutions: propose new algorithm or speed up existing algorithms, by using multiprocessor computers, GPU or grid to make faster computation. Presented solution is a parallel version of the assembly algorithm based on a graph model. Parallelism was introduced in a few procedures: calculation of the overlap of each pair of input sequences, searching for longest paths in the graph, creating of consensus sequences.

Darkened TF-06

Tuesday 16:05-17:25

Chair:
Ioannis Minis, Financial and Management Engineering, University of the Aegean, Fostini 31, 82100, Chios, Greece, i.minis@fme.aegean.gr,
Vasileios Zeimpekis, Department of Financial and Management Engineering, University of the Aegean, Fostini 31, 82100, Chios, Greece, vzeimp@fme.aegean.gr,
George Ninikas, Theodore Athanasopoulos, Ioannis Minis

Innovative Applications of OR in Supply Chains

Invited session

Stream: OR and Real Implementations

Vassiliou Vrisagotis, Department of Logistics Management, Technological Educational Institute of Chalkis, 32200, Thiva, Greece, brisxri@otenet.gr,
Georgios Kaimakamis, Christina Beneki, Konstantinos Siassiakos

Cross docking is a technique that eliminates storing and order picking functions of a warehouse while still allowing it to serve its receiving and shipping functions. Main issues are the calculation of the number of the building’s gates and size of the facility through the calculation of facility’s width. We correspond in these two issues by modeling a cross-docking distribution center as a network of queues by using Markov stochastic processes. Then we refer to an application in a leader retailer in Greece.

2 - An intelligent fleet management system for real-time courier services

Vasileios Zeimpekis, Department of Financial and Management Engineering, University of the Aegean, Fostini 31, 82100, Chios, Greece, vzeimp@fme.aegean.gr,
George Ninikas, Theodore Athanasopoulos, Ioannis Minis

The need for higher customer service and minimization of operational costs led many courier companies to seek innovative systems for managing customer requests that occur during the planning and/or the execution of daily deliveries. This paper presents the design and implementation of an innovative fleet management system that handles in a dynamic manner the requests that arise during delivery execution and at the same time routes effectively deliveries that are planned in a multi-day framework. The proposed system is tested in real-life scenarios in a Greek courier operator.

3 - A stochastic model for evaluating the vulnerability of a supply network

Claudia Colicchia, Logistics Research Center, Carlo Cattaneo University LIUC, Corso Matteotti 22, 21053, Castellanza, Italy, ccolicchia@liuc.it,
Fernanda Strozzi, Carlo Noe, Ljupco Kocarev

Supply chain vulnerability has gained considerable attention, since the more complex the relationships, the more prone modern global supply chains are to disruptions. As vulnerability increases, there needs to develop effective mathematical tools for its evaluation. The purpose of this paper is to assess the vulnerability of a network in a global logistics environment using the Influence Model, a stochastic model composed of interactive Markov Chains. The aim is to foster a more explicit understanding of the relationships between network characteristics and vulnerability of supply chains.

Darkened TF-07

Tuesday 16:05-17:25

Invited session

Stream: Optimization in Public Transport

Chair:
Fabien Leurent, DPER, SETRA, 46 avenue A. Briand, 92 225, Bagnieux, FRANCE, France, fabien.leurent@equipeement.gouv.fr

1 - A systemic analysis of congestion in a transit network

Fabien Leurent, Laboratoire Ville, Mobilité, Transport, Université Paris-Est, Enpc, 6-8 avenue Blaise Pascal, Cité Descartes, Champs sur Marne, 77455, Marne la Vallée, Cedex 2, France, fabien.leurent@enpc.fr

An analysis framework is provided for congestion phenomena in public transit networks, in order to identify the relevant limited resources and the congestion mechanisms on passengers and/or vehicles. Four basic subsystems are considered, namely: (i) line; (ii) vehicle; (iii) station; (iv) passenger. By subsystem, the specific congestion phenomena are identified and described qualitatively, with indication of how to model them in a relevant way. The associated optimization problems of route choice and network traffic equilibrium are outlined.
2 - On congestion phenomena in static models of traffic assignment to transit networks

Fabien Leurent, Laboratoire Ville, Mobilité, Transport, Université Paris-Est, Enpc, 6-8 avenue Blaise Pascal, Cité Descartes, Champs sur Marne, 77455, Marne la Vallée, Cedex 2, France, fabien.leurent@enpc.fr

The paper is purported to model congestion phenomena in a public transit network in a straightforward way applicable to many kinds of limited resources, and to adapt correspondingly the optimal strategy model of Spiess and Florian (1989). A richer framework is developed, in which the congestion state induces the rider to choose her queuing area prior to choosing a service from among a subset which is conditional on the queuing area and state. This is stated as a primal-dual program, solved using an augmented Lagrange scheme. Numerical application to the metropolitan Paris area is provided.

3 - Schedule-based dynamic assignment models for congested urban transit networks

Umberto Crisalli, Department of Civil Engineering, University of Rome, via del politecnico 1, 00133, Rome, Italy, crisalli@ing.uniroma2.it, Agostino Nuzzolo, Luca Rosati

This paper presents a schedule-based dynamic assignment model, which explicitly takes into account vehicle capacity by representing each run of transit services through a diachronic network. The core of the assignment model is the use of a joint departure time, stop and run choice model based on a mixed trip/eng-route choice behaviour, in which some attributes and congestion (fail-to-board experiences), that are defined at single vehicle (run) level, are estimated by day-to-day learning processes. Finally, an application example to a realistically-sized test network will be presented.

This paper aims to compare the efficiency of Drum Buffer Rope (DBR) approach of Theory of Constraints (TOC) in production planning with the well known anchoring and adjustment approach. This comparison is based on a System Dynamics (SD) model representing a three-stage flow shop system that produces a single product. The simulation results of the SD model are specific performance measures of the production and the raw material procurement processes of the model. The impact of specific control parameters on the performance measures is investigated by means of Analysis of Variance (ANOVA).

3 - A framework to model reduction and stability analysis for supply chains

Thomas Makuschewitz, IPS - Intelligent Production and Logistics Systems, BIBA - Bremer Institut für Produktion und Logistik GmbH at the University of Bremen, Hochschulring 20, 28359, Bremen, Bremen, Germany, mak@biba.uni-bremen.de, Bernd Scholz-Reiter, Michael Kosmykov, Michael Schönle

Supply Chains often consist of a large number of geographically distributed production facilities. The material flow within these networks is subject to the complex structure as well as to external and internal dynamics. In this paper we present a framework for stability analysis of a supply chain based on a representative fluid model. Excluding less important locations of the network leads to a fluid model of lower size that performs in the same manner. Important locations are determined by an adaptation of the PageRank algorithm, which takes network structure and material flow into account.

4 - Modeling defaults of companies in multi-stage supply chain networks

Stephan Wagner, Department of Management, Technology, and Economics, Swiss Federal Institute of Technology Zurich (ETH Zurich), Chair of Logistics Management, Scheuchzerstrasse 7, 8092 , Zurich, Switzerland, stwagner@ethz.ch, Kamil Miziag, Janusz Holyst

Our approach to study supply chain networks as complex systems draws on the concept of heterogeneous interacting agents in a repeated process of orders and production. Due to random failures the dynamics of production in the network is nonlinear. We focus on the influence of local processes on the global economic behavior of the system. We introduce a supply chain network model with the following features which better reflect the real economic environment: evolution of a supply chain network with the reconfiguration of links, price dispersion and the dynamics of prices and costs of production.
We explore the combinatorial aspects of different approaches to personnel rostering. We focus on practices in the UK NHS, and other cases in the Nurse Rostering literature. Rotas are a set of weekly shift patterns through which staff rotate. We formulate the rota problem as an Integer Programme. A Roster, by contrast, matches staff supply to demand, and patterns of work over the week are more freely defined. Contrasting results are presented from two, or more, NHS wards, and their impact highlighted. Manual and optimised schedules are presented and discussed for both rotas and rosters.

To ease the user’s modelling effort and reduce errors when using TEMPLE, a language designed for modelling and solving staff scheduling problems, we propose two testing approaches. The first one utilizes small, self-contained tests that verify the user’s logic. The second one consists of larger tests using a model’s objects themselves, which check the system’s correct processing of the user input. These tests aim at verifying the code and the entire model itself. Due to this approach errors in a problem model are identified at an early stage.

To show how this framework can be the basis of a computationally practical interactive scheme and demonstrate this scheme with examples drawn from practice.

We present TEMPLE, a language designed for modelling and solving staff scheduling problems, in TEMPLE it can be solved automatically by using a generic local-search-based solver. We demonstrate how real-life staff scheduling problems can be modelled with TEMPLE and show that the solutions obtained with our approach are of satisfying quality.

We show how this framework can be the basis of a computationally practical interactive scheme and demonstrate this scheme with examples drawn from practice.

The decision quality framework has been useful in guiding decision processes and analyses. Translating the framework to the context of portfolio decisions requires that we address their specific analytical and organizational characteristics. In some ways, the translation is direct, e.g., valuing outcomes. In some ways, elements have different meanings for portfolios, e.g., creative alternatives. In some ways, portfolio decisions have unique quality demands, e.g., identifying synergies between projects. We define elements of portfolio decision quality and a four level quality scale for each.

We present a novel interactive approach for the Multi-Criteria Portfolio Selection Problem (MCPSp). This is based on new results for identifying preferred solutions to Multi-Objective Binary Optimisation problems. We present new formulations for the MCPSp which integrate the decision space with the criterion space. These allow for incorporating preference information directly and identifying preferred efficient portfolios accordingly.

Project portfolios are often built by selecting the projects which have the best prior estimates about their future performance. Because these estimates are uncertain, the selected projects are likely to have estimates that are higher than the projects’ actual realized performance. This gives rise to the optimizer’s curse phenomenon which is here analyzed in view of key decision parameters (e.g., quality of estimates, number of proposals and funded projects) at the portfolio and project levels. We also consider implications for project funding and information acquisition strategies.
Multicriteria evaluation, information systems and agents

Stream: Multiple Criteria Decision Analysis
Invited session
Chair: Pascal Oberti, Université de Corse, UFR Droit Economie., Av. Jean-NICOLI, BP 52, 20250 CORTE, 20250, Corte, France, pascal.oberti@univ-corse.fr

1 - Introduce an outranking method as a substitute to a synthetic index in monitoring and evaluation of public policies and programs
Maud Huaulme, Economic, CREM-CNRS, 7, Place Hoche, 35005, Rennes Cedex, France, maud.huaulme@univ-rennes1.fr, Maurice Baslé

On going evaluations focus on the chain outputs-outcomes-effects or impact of current public policies. Targets are supposed to be produced by policymakers. Do we want quantitative or qualitative materials, intermediate or more synthetic indexes? Maurice Baslé has proposed an original process of monitoring and evaluation. Then, it is easier to define a performance indicators holding indicators of results. We deal with the methodologies of multicriteria decision aid to aggregate these indicators of results and to build in this way a composite indicator.

2 - Actors roles and software interface users rights in a multicriteria evaluation process : state of the art and proposals
Christophe Paoli, Universite de Corse, 20250, CORTE, France, christophe.paoli@univ-corse.fr, Pascal Oberti

The participation of actors in multicriteria evaluation processes of alternatives is a challenge for the analyst. Various contributions exist [Roy, 1996][Froger, Oberti, 2002][Oberti, 2004][Munda, 2004][Jabeur, Martel, 2005]. First we will present how is studied the structure of evaluation process. In a second time, we will propose an implementation through MECADEPPE software [Oberti et al., 2008], translating the actor roles into user rights in order to represent a real process. Finally we will present an illustration of a participatory evaluation for energy projects.

3 - Multicriteria outranking evaluation of energy options in insular contexts: application of electre models in greece and corsica
Matteaccioli Paul-François, Université de Corse, 20250, CORTE, France, pf.matteaccioli@sartene.fr, Pascal Oberti

Energy planning in insular context is a complex exercise, because of varied factors: particular status, overcost of basic production, strong seasonal variations with tourist consumption, frequent power cuts, multilevel public decision, strong local demand of participation and NIMBY syndrome, important potential of renewable energies to be exploited, etc. This research aims at studying how the ELECTRE multicriteria methods [Figueira and al., 2005], can help with the evaluation of energy options [Georgopoulou and al., 2003, 1997] [Oberti, Matteaccioli, 2008] [Papadopoulos, Karagiannis, 2008].

Tools for stochastic optimization
Stream: Stochastic Programming
Invited session
Chair: Tamas Szantai, Institute of Mathematics, Budapest University of Technology and Economics, Muegyetem rkp. 3., 1111, Budapest, Hungary, tsantai@math.bme.hu

1 - Successive regression approximations in stochastic programming
Istvan Deak, Computer Science, Corvinus University of Budapest, Fovam ter 8., 1093, Budapest, Hungary, istvan.deak@uni-corvinus.hu

Recently a new iterative method has been developed for solving problems with noisy function values, which uses iteratively updated regression functions. First we give details of the method for solving an equation with noisy function evaluation, highlighing the main ideas and the computational problems. Then we summarize stochastic programming problems, where this technique was applied successfully, according to extensive numerical experiments (probabilistic constrained and two stage problems, a combined model and random linear problems are dealt with).

2 - Bounding the reliability of a stochastic transportation network with random demands and arc capacities
Andras Prekopa, RUTCOR, Rutgers University, 640 Barholomew Road, 08854-8003, Piscataway, New Jersey, United States, prekopa@rutcorg.rutgers.edu, Merve Unuvar

Bounding the reliability of a transportation network was proposed by Pr kopa and Boros (Op.Res.39, 119-129), where the demand values are random and binomial moment bounds are used. In many practical applications (flood control, evacuation), however, the arc capacities are also random. This makes the number of feasibility constraints very large. We propose efficient elimination procedures of the redundant constraints and use up to date bounding technique to approximate the probability of the existence of a feasible flow.

3 - Models for the determination of the irrigation water supply in streamflows
Tamas Szantai, Institute of Mathematics, Budapest University of Technology and Economics, Muegyetem rkp. 3., 1111, Budapest, Hungary, szantai@math.bme.hu, Andras Prekopa

Three stochastic programming models will be presented. The first one serves to determine the amount of water that can be used, by a large probability, where there is no storage possibility. In the second model we assume that the water can be stored in reservoir and the problem is to determine its optimal capacity. In the third model we allow that for a few number of days there is not enough water for irrigation. The tools for numerical solution of the mathematical models are Matlab codes and AMPL modeling language.
1 - The uniform capacitated f& on path network

Alexander Kurochkin, mechanic-mathematical, Novosibirsk State University, Pirogova, 2, 630090, Novosibirsk, Russian Federation, alkurochkin@ngs.ru, Edward Gimadi, Alexander Ageev

It is known that Capacitated Facility Location Problem (CFLP) on path network is NP-hard for arbitrary capacities of facilities. We consider the CFLP on path network when capacities of facilities are equal. Earlier for this problem $O(m^5n^2 + m^3n^3)$-time complexity algorithm was constructed by A.Ageev. In this report a modification of the algorithm is presented. The running time of the algorithm is equal to $O(m^4n^2)$. So it has smaller complexity respective the $O(n^3)$-time complexity.

2 - Locating facilities in a dense grid network where travel times follow gravitational patterns

Francisco A. Ortega, University of Seville, 41012, Seville, Spain, riejos@us.es

( Lúcio A. Ortega, Juan A. Mesa & Rosario Arriola)

For urban settings, a common objective to decide the location of facilities is the minimization of the maximum travel time between demand points and such sites. Excluding other external factors, travel time depends mainly on the distance along the feasible street network and the transit speed on this network. The location problems dealt with in the paper combine rectilinear trajectories with a distribution of levels of velocity in a dense grid of streets which follows an inverse gravitational model, according to a given orientation.

3 - Locating speed-up networks

Marie Schmidt, Institut für Numerische und Angewandte Mathematik, Georg-August-Universität Göttingen, Lotzestrasse 16-18, 37073, Göttingen, Germany, marie_schmidt@gmx.net, Anita Schoebel

Let a network together with a set of origin-destination pairs (OD-pairs) be given. We consider the problem of locating a subnetwork of given length along which travel times are reduced by a given speed-up factor. The OD-pairs can choose to use the new subnetwork if this is the faster option for them. Our goal is to locate the subnetwork so that the largest traveling time of all OD-pairs is minimized. An application is the location of a rapid transport network within a city. We present various NP-completeness results and efficient algorithms depending on the types of the networks involved.

1 - Integrated planning of spare parts and service tools

Ingrid Vliegen, Industrial Engineering and Innovation Sciences, Technische Universität Eindhoven, P.O. Box 513, 5600 MB, Eindhoven, i.m.h.vliegen@tue.nl, Geert-Jan van Houtum

To perform a maintenance action, spare parts, service tools and service engineers need to be available. In this talk, we focus on the planning problem for a combination of tools and parts, and base ourselves on an actual planning problem of an Original Equipment Manufacturer in the semiconductor supplier industry. We consider a multi-locational, multi-item inventory model, in which demands occur for sets of parts and tools. Our objective is to minimize the investment in service tools and spare parts, subject to meeting the service level agreed upon with customers.

2 - End of life inventory decisions for consumer electronics spare parts

Morteza Pourakbar, Erasmus School of Economics, Econometric Institute, Erasmus University Rotterdam, BurgOudlaan 50, 3000 DR, Rotterdam, pourakbar@ese.eur.nl, J.b.g. Frenk, Rommert Dekker

we consider a consumer electronics(CE) manufacturer problem of controlling the inventory of spare parts in the final phase. Final phase starts upon termination of production and lasts till last service contract expires. Previous works consider repair of the parts as the only way to serve customers. For CE products since they are subjected to remarkable price erosion over time other policies such as swapping might be profitable. We accommodate alternative policy into final phase inventory policies and develop models to optimize both final order quantity and time to switch to alternative policy.

3 - An integrated approach for level of repair analysis and spare parts stocking using marginal analysis

Matthieu van der Heijden, Operational Methods for Production and Logistics, University of Twente, P.O. Box 217, 7500 AE, Enschede, m.c.vanderheijden@utwente.nl, Rob Basten, Erhan Kutanoğlu, Marco Schutten

When developing a capital good, we should decide how to maintain it once it is in the field. The level of repair analysis is used to decide: 1) Which components should be repaired upon failure and which should be discarded, 2) Where components should be repaired 3) Where resources (e.g. testers) should be deployed. Next, we should decide how many spare parts for each component are needed where in the network to guarantee a certain product availability. We develop an integrated optimization method to support these decisions and illustrate it using a case study in industry.
Project Scheduling - Extensions and Applications

Stream: Project Management and Scheduling

Invited session

Chair: Jürgen Zimmermann, Operations Research, TU Clausthal, Julius-Albert Str. 2, 38678, Clausthal-Zellerfeld, Germany. juergen.zimmermann@tu-clausthal.de

1 - Real time planning system for a multi-channel support centre

M. Pilar Lino, Mathematics for Economy, University of Valencia, Avda Naranjos s/n, 46021, Valencia, Spain, pilar.lino@uv.es, M. Angeles Pérez, Sacramento Quintanilla, Vicente Valls

The objective is to aid in the automatic planning of the daily activities of service centres using ITC, developing a user interface which includes the scheduling of tasks and the management of human resources by means of project scheduling techniques. We present software which analyses, numerically and graphically, the proposed plans. The interface allows the managers to modify, in the Gantt charts, the schedule of a set of tasks. The system updates all the information related to the fulfilment of the service quality agreements and the worker loads, both individually and by areas of knowledge.

2 - A voting-based heuristic for decentralized multi-project scheduling

Jörg Homberger, Alpenrenstr. 26, 70563, Stuttgart, joerg.homberger@hft-stuttgart.de

A voting-based heuristic for the Decentralized Resource Constrained Multi-Project Scheduling Problem is described. The heuristic combines several priority rules and schedule generation schemes, applied decentrally by project planning agents, with several synchronization rules for the access of the agents to shared resources. The combination of rules leads to a set of solutions from which one is chosen by the agents through voting. The approach, which takes asymmetric information into account, is evaluated on 140 benchmark instances taken from the literature.

3 - Introduction of learning effects in resource-constrained projects

Vincent Van Peteghem, Faculty of Economics and Business Administration, Ghent University, Tweekerkenstraat 2, 9000, Gent, Belgium, vincent.vanpeteghem@ugent.be, Mario Vanhoucke

Learning effects assume that a resources’ efficiency increases with the duration of a task. Although these effects are commonly used in machine scheduling environments, they are rarely used in a project scheduling setting. We study learning effects for the discrete time-resource tradeoff scheduling problem, where for each activity a work content is specified and different execution modes (duration/resource requirement pairs) are defined. Computational results emphasize the significance of the effect and reveal promising results for specific project networks.

4 - Exact methods for the resource levelling problem

Thorsten Gather, Operations Research Group, Clausthal Institute of Technology, Julius-Albert-Str. 2, 38678, Clausthal, Niedersachsen, Germany, gather@tibase.de, Jürgen Zimmermann

Project management in present time is characterized by hardly calculable risks and very tight deadlines. Project Managers must consider carefully the resources required to complete a project on time and within the budget. As a consequence, the levelling of resources gets more and more attention. We consider a new tree-based enumeration method exploiting fundamental properties of spanning trees and order polytopes to minimize the variation of resource utilization in the course of projects. To solve larger problem instances we embedded the enumeration in a branch and bound procedure.

Multiple Objective Combinatorial Optimization

Stream: Multi-Objective Optimization and Decision Theory 1

Invited session

Chair: Jochen Gorski, Department of Mathematics and Informatics, University of Wuppertal, Gaulstraße 20, 42119, Wuppertal, Germany, gorski@math.uni-wuppertal.de

1 - Combinatorial optimization with generalized bottleneck objective(s)

Jochen Gorski, Department of Mathematics and Informatics, University of Wuppertal, Gaulstraße 20, 42119, Wuppertal, Germany, gorski@math.uni-wuppertal.de, Kathrin Klamroth, Stefan Ruzika

In Combinatorial optimization (CO) both the sum objective as well as the bottleneck objective are of great interest. While using sum objectives often leads to NP-hard problems, problems with bottleneck objectives can often be solved more efficiently. We introduce a class of generalized bottleneck objectives where instead of the largest cost coefficient of a solution, its k-largest cost coefficient has to be minimized. We discuss theoretical properties and present algorithms for solving CO problems with one and more k-max objectives in the single and multiple criteria case, respectively.

2 - A linear-time algorithm for the binary bicriteria spanning tree problem

Stefan Ruzika, Department of Mathematics, University of Kaiserslautern, P.O. Box 3049, 67653, Kaiserslautern, Germany, ruzika@mathematik.uni-kl.de, Jochen Gorski, Kathrin Klamroth

Consider an extension of the minimum spanning tree problem for undirected graphs G=(V,E): Let two cost functions c: E -> 0,1 and d: E -> 0,1 be given. The resulting problem is called the binary bicriteria spanning tree problem. Our goal is to compute all non-dominated points and for each nondominated point one efficient solution. First, we modify graph G, thus taking care of all edges with dominated points and for each nondominated point one efficient solution. Finally, we introduce a class of generalized bottleneck objectives where instead of the largest cost coefficient of a solution, its k-largest cost coefficient has to be minimized. We discuss theoretical properties and present algorithms for solving CO problems with one and more k-max objectives in the single and multiple criteria case, respectively.

3 - On the bicriterion — minimum cost/minimum label — spanning tree problem

João Clímaco, Faculdade de Economia da Universidade de Coimbra and INESC-Coimbra, 3004-512, Coimbra, Portugal, jclimaco@fe.uc.pt, Maria Eugénia Captivo, Marta Pascoal

Consider an extension of the minimum spanning tree problem for undirected graphs G=(V,E): Let two cost functions c: E -> 0,1 and d: E -> 0,1 be given. The resulting problem is called the binary bicriteria spanning tree problem. Our goal is to compute all non-dominated points and for each nondominated point one efficient solution. First, we modify graph G, thus taking care of all edges with costs (0,0) and (1,1). The resulting graph has edges with costs (0,1) or (1,0). Efficient characterization and computation of all non-dominated points for this and for the original graph can be achieved.
In the bicriterion — minimum cost/minimum label — spanning tree problem, each edge of the network is assigned with a cost value and a label (such as a color). The first criterion intends to minimize the total cost of the spanning tree, while the second intends to determine a spanning tree with a minimum number of different labels. This problem has applications in telecommunication or transportation networks. As generally these are conflicting criteria, we developed algorithms to generate the set of non-dominated spanning trees. Computational experiments are presented and results discussed.

4 - Numerical studies of tchebycheff-type approaches for solving multicriteria optimization problems
Kerstin Daechert, Department of Mathematics and Natural Sciences, University of Wuppertal, Gaussstr. 20, 42119, Wuppertal, Germany, kerstin.daechert@math.uni-wuppertal.de, Jochen Gorski

Compromise programming and reference point methods have in common that weakly efficient solutions are generated by minimizing the distance between a feasible point in the decision space and a reference point. In Tchebycheff-type approaches a utopian point is typically chosen as this reference point. Another possibility consists in taking local utopian points with respect to the coordinates of a subset of (weakly) efficient solutions generated so far. We study the influence of the chosen reference points by comparing the quality of the generated solutions and computation time.

— TF-17 —

TF-17
Tuesday 16:05-17:25
Rheinnaue
Cutting and Packing and Metaheuristics

Invited session
Chair: Marc Sevaux, EU/ME, Université de Bretagne Sud - UEB, Lab-STICC - CNRS UMR 3192, Centre de Recherche - BP 92116, 56321, Lorient, France, marc.sevaux@univ-ubs.fr

1 - Box loading optimization into containers via tabu search
Vitoria Puraçza, Production Engineering, Universidade Federal de Sao Carlos, Via Washington Luiz, km 235, 13564-090, Sao Carlos, Sao Paulo, vpuraçza@dep.ufscar.br

In this paper, it is proposed a tabu search algorithm for arranging heterogeneous or homogeneous loads of rectangular boxes into containers. Computational results regarding volume utilization and stability measures are presented for sets of benchmark instances.

2 - Enhancement of a commercial software for layout planning by a tabu search algorithm
Axel Hennig, rhenag Rheinische Energie Aktiengesellschaft, Cologne, Germany, 50937, Köln, Germany, axel-hennig@gmx.de, Andreas Bortfeldt, Hermann Gehring

The integration of a tabu search algorithm (TSA) into an existing commercial program for planning the layout of factories is investigated. The TSA places rectangular shaped facilities on a given factory area in such a way that the costs of specified material flows are minimized. It can be utilised both for automated calculations and as an assistance tool within interactive planning of layouts. Results will be reported concerning both operating modes of the TSA.

3 - Hybrid parallel genetic approach for one-dimensional bin packing problem
Roman Potarusov, 87/40, Petrovskaya St., 347900, Taganrog, Russian Federation, potarusov.roman@gmail.com, Gilles Goncalves, Hamid Allaoui, Victor Kureyчик

We propose the Hybrid Parallel Genetic Approach (HPGA) for one-dimensional Bin Packing Problem (BPP), which can compete with the best known solution methods and provides quasi-optimal and optimal BPP solutions for all benchmarks instances in an acceptable amount of computing time. HPGA was tested on 1370 benchmark test problem instances. We found optimal solutions for 1365 problem instances. For remaining 5 we obtained near optimal solutions. In the case of quasi-optimal solutions the absolute deviation from reference solution is at most one bin. The computing time doesn’t exceed 30 seconds.

— TF-18 —

TF-18
Tuesday 16:05-17:25
Lenné
Parallel Nonlinear Programming Algorithms

Invited session
Chair: Figen Öztöprak, Industrial Engineering, Sabanci University, Sabanci University, FENS 1021, Orhanli - Tuzla, 34956, Istanbul, Turkey, figen@su.sabanciuniv.edu
Chair: S. İker Birbil, Manufacturing Systems/Industrial Engineering, Sabanci University, Orhanli, 34956, Tuzla, Istanbul, Turkey, sibirbil@sabanciuniv.edu

1 - Parallel programming approaches to nonlinear optimization
Figen Öztöprak, Industrial Engineering, Sabanci University, Sabanci University, FENS 1021, Orhanli - Tuzla, 34956, Istanbul, Turkey, figen@su.sabanciuniv.edu, S. İker Birbil

The common motivation for using parallel processing in nonlinear optimization is to speed up the execution of existing sequential algorithms. In this study, we argue that parallel processing can provide further performance improvements by means of parallel generation and exchange of information, which requires the design of appropriate interaction strategies and results in modifying the original algorithms. We apply our idea to some well-known methods of nonlinear optimization and present some numerical results.

2 - A parallel version of the probabilistic method of feasible directions
Art Gorka, Department of Mathematics, Erskine College, 2, Washington Street, Box 338, 29630,Due West, SC, United States, art.gorka@erskine.edu, Michael Kostreva

A Parallel version of the Probabilistic Method of Feasible Directions, designed to solve nonlinear optimization problems with inequality constraints, is presented. The algorithm uses parallel processes to find multiple directions of search for Fritz John point. It is tested on a number of problems with known solutions to compare the method with earlier versions. An estimation of the speed of the algorithm is given.

3 - On parallelization of ant colony-based algorithms
Andrzej Chu, U Uranie 25, 17000, Prague, chu@fel.cvut.cz
This article deals with the problem of parallelization of algorithms based on ant colony optimization metaheuristics. It suggests some solutions on designing parallel ant colony systems. When implementing an ant colony based algorithm that should run on parallel systems, one should be aware of several problems that may arise. Also, an analysis is needed on such operations, which could be implemented either on the server and/or client side, as there always is a trade-off between the clients’ memory consumption and communication resources consumption.

4 - Formulating and solving non-standard model types using gams/emp

Jan-Hendrik Jagla, GAMS Software GmbH, 50933, Cologne, Germany, hjjagla@gams.com, Michael Ferris, Alex Meeraus

Many new model types are emerging that involve more complex features than current modeling systems are able to convey easily. We will outline an extended mathematical programming framework, as implemented in GAMS/EMP; that enables additional structural information to be described. We will demonstrate several examples of the use of EMP to formulate and solve problems (such as bilevel programs and variational inequalities) more reliably. The framework is easily extensible and also provides mechanisms to perform standard reformulations of models for solution by existing codes.

In-flight catering company has to transport meal from the kitchen to the apron in the airport. The loading scheduling is constrained by the service time window of an aircraft, the food exposure time limit of meals and the truck capacity. Since demand is spread unevenly across the day with peak and non-peak hours, a flexible shift pattern is applied; loading team can start and finish shift at different hour. A matching and pairing heuristic is developed to minimum manpower required in fulfilling demand across a 24 hours day. Computational result shows a 25 percent of manpower savings

3 - A genetic algorithm approach to the container loading problem

Ana Moura, Economy, Management and Industrial Engineering, University of Aveiro, Campus Universitário de Santiago, 3810-193, Aveiro, Portugal, ana.moura@ua.pt, Rui Rijo

The problem considered in this work is the Container Loading Problem. In this problem a set of rectangular boxes has to be packed in one rectangular container so that the available container space usage is maximized. The orientation constraints and the distinction between homogeneous and heterogeneous types of cargo are considered. We present the results obtained with a Genetic Algorithm approach. The good performance of this algorithm is shown by comparing them with well-known algorithms and results from the literature.

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We consider how DEA efficiency estimates can be used to determine revenue caps in a yardstick regulation model. The cost norms must be set such that they allow for super efficiency. This means that the averagely efficient company should earn the rate of return set by the regulator, and the companies should be allowed to realize extra profits if they improve their efficiency. If there are time lags with respect to the reporting of cost and production data, the revenue caps must be adjusted for this. We use data for Norwegian distribution and regional transmission companies in our analyses.

3 - Analyzing the performance of Indian maritime states using DEA

Neelangshu Ghosh, Business Administration, Siliguri Institute of Technology, Hill Cart Road, Sukna, Dist-Darjeeling, West Bengal, India, 734009, Siliguri, West Bengal, India, neelgh@rediffmail.com. Ajit K Ray

For understanding the scope of improvement and identifying the areas of inefficiencies of Indian Maritime States in marine fishery, we evaluated, compared and analyzed their performances for the years 2003 & 2005. We applied DEA BCC-O model with two contributing categories of resources as inputs: geographical & fishing fleet against harvest as output. Inclusion of number of inputs in DEA model being limited by the conventional rule only those verified as independent by Frisch’s Confluence Analysis are incorporated. The analysis may help in optimizing underperforming maritime states in future.

4 - DEA method in efficiency and productive analysis of Moldovan industry

Tkacenko Alexandra, Applied Mathematics, Moldova State University, Alexei Mateievi str. 60, 2009, MD, Chisinau, Moldova, Republic Of, tkacenko@moldovacc.md

In this work we will present an analysis of the economic situation of some branches in Moldova. This was possible using the DEA technique, based on mathematical programmer approach, especially the linear-fractional optimization models. We’ve provided an analysis of some certain data concerning 17 sectors of Moldovan industry. Using the Efficiency Measurement Programs (EMS)we calculate the indexes of efficiency scores of them, then, underlining their efficiency or inefficiency. The proposed studies cover the period after collapse of totalitarian system.

The paper presents a two-stage model for evaluation and ranking of decision making units based on the analytic hierarchy process (AHP) with interval pairwise judgments and data envelopment analysis (DEA) with weight restrictions. The first stage of the model consists in assessment of weights of input and outputs by means of the interval AHP model. The second stage uses a DEA model with weight restrictions for evaluation of efficiency. The proposed modeling approach is applied in assessing the efficiency of bank branches of one of the most important banks in the Czech Republic.

3 - An environmental risk assessment methodology proposal for industrial hazardous materials

Emel Topuz, Environmental Engineering, ITU, ITU Ayazaga Yerleskesi Insaat Fakultesi, Cevre Muhendisligi Bolumu Maslak, 34469, ISTANBUL, Turkey, topuze@itu.edu.tr, Ilhan Talinýlý

This study aims to propose a methodology using AHP and fuzzy logic to assess environmental risk of industrial hazardous materials. AHP provides to organize the indicators of risk in a systematic way to simplify the assessment and decision making. This approach benefits from the ability of fuzzy logic to reflect expert opinion by de- priving the effects of uncertainty and complexity in environmental issues. Following the hierarchical structure and output of methodology leads decision makers to the source of risk which provides to manage risk and allows the substance to be utilized safely.

TF-21

Tuesday 16:05-17:25

AHP II

Invited session

Chair: Josef Jablonsky, Dept. of Econometrics, University of Economics Prague, W.Churchill sq. 4, 13067, Prague 3, Czech Republic, jablon@vse.cz

1 - A two-stage ahp/dea model for evaluation of efficiency

Josef Jablonsky, Dept. of Econometrics, University of Economics Prague, W.Churchill sq. 4, 13067, Prague 3, Czech Republic, jablon@vse.cz

TF-22

Tuesday 16:05-17:25

Environmental Planning

Invited session

Chair: Franz Nelissen, GAMS Software GmbH, Eupener Str. 135-137, 50933, Cologne, Germany, FNelissen@gams.com

1 - Targeting the removal of artificial in-stream barriers for the benefit of resident fish

Jesse O’Hanley, Kent Business School, University of Kent, KBS, Canterbury, Kent, CT2 7PE, Canterbury, johanley@kent.ac.uk, Matthew Diebel, Mark Fedora, Jed Wright
2 - Environmental taxes and the choice of pollution-reducing technology
Anton Ovchinnikov, University of Virginia, Darden School of Business, 100 Darden Blvd, 22903, Charlottesville, VA, aovchinnikov@darden.virginia.edu

We study how environmental taxes affect the choice of pollution-reducing technology. In our model, the regulator sets the tax level, and the firm chooses production quantity and price, as well as choosing among production technologies that vary in efficiency, fixed and variable costs. We show that firm’s reaction is non-monotone: as tax level increases the firm first switches from dirty to clean technology, but further increase motivates a reverse switch. This reverse effect could be avoided with subsidy. We finally discuss in a Stackelberg framework how the regulator sets the tax level.

3 - Choice of alternative environmental policies with quadratic costs under uncertainty
Motoh Tsujimura, Faculty of Economics, Rikoku University, Fukakusa Fushimi-ku, 612-8577, Kyoto, Kyoto, Japan, tsujimura@econ.ryukoku.ac.jp, Makoto Goto

This paper investigates the environmental policy designed to reduce emissions of a pollutant under uncertainty. We consider that the costs to implement the policy are divided into the fixed cost, the proportional cost, and the quadratic adjustment cost. Further, we consider the agent has two policy options. Then, the agent must decide that which policy he implements and when he implements the policy to maximize his benefit. To solve the agent’s problem, we formulate it as an optimal stopping problem. Furthermore, we present the comparative-static analysis of the thresholds.

1 - E-government: a comparative study of the g2c online services progress using multi-criteria analysis
Denis Yannacopoulos, TECHNOLOGICAL EDUCATIONAL INSTITUTE OF PIRAEUS, 12244, EGALEO, Greece, dgi@teipir.gr, Panagiotis Manolitzas, Athanasios Spyridakos

In this paper we investigate the progress of online services delivery. We will analyze the web services that the governments of European Union providing to citizens. Besides a comparative measurement of the progress of online services delivery is presented using MINORA System (Multi-criteria Interactive Ordinal Regression Analysis) Weights criteria and a global utility function, emerged by the application of MINORA system have argued and justified the classification proposed by the EU officers.

2 - Web-based decision support through kernel density estimation and combination
Antonio Rodrigues, CIO-FCUL, University of Lisbon, Edificio C6, Campo Grande, 1794-016, Lisboa, Portugal, ajrodrigues@fc.ul.pt

We present and describe a simple web-based application demo, for demand forecasting, risk analysis and optimal decision-making. In this, we demonstrate two possible uses of kernel density estimation and combination: in the context of expert opinions elicitation and aggregation, and in the context of time series density forecasting. We also seek to demonstrate how users can benefit from sophisticated decision aid with minimum hassle through a simple web browser interface.

3 - Towards a collaboration network for the euro working group on dss (ewg-dss)
Fatima Dargam, SimTech Simulation Technology, Ries Strasse 120, 8010, Graz, Austria, F.Dargam@SimTechnology.com, Rita Ribeiro, Pascale Zarate

The objective of this work is to create a social-academic network for the EWG-DSS, using as its defined population, the academic members of the group. The main motivation is to analyse and represent the various relationships that link academically the almost 100 members of the Group. We will evaluate the group’s collaboration dynamics since 1989. We aim to encourage new research and promote further collaboration among the academic members of the group in common projects and joint-publications, since their current areas of research will be revisited and focused by this study.
In this research, we focus on two-level nonlinear programming problems, in which there is not coordination between the decision maker at the upper level (the leader) and the decision maker at the lower level (the follower), and propose a computational method using particle swarm optimization (PSO) for obtaining Stackelberg solutions to two-level nonlinear programming problems. Moreover, we carry out numerical experiments in order to demonstrate feasibility and effectiveness of the proposed method by comparing with existing methods.

**TF-25**

**Tuesday 16:05-17:25**

**GSI - S 25**

**Game Theory**

Stream: Dynamical Systems and Game Theory

**Invited session**

Chair: Flávio Ferreira, Mathematics, ESEIG - Instituto Politécnico do Porto, R. D. Sancho I, 981, 4480-876, Vila do Conde, Portugal, flavioferreira@eu.ipp.pt

1. **Hotelling’s duopoly and location game on the plane**
   Vladimir Mazalov, Institute of Applied Mathematical Research, Karelia Research Center, 185090, Petrozavodsk, Karelia, Russian Federation, vmzalov@krc.karelia.ru, Julia Tokareva

We analyze Hotelling’s duopoly model on the plane. There are two firms located in different points inside a circle and the customers are distributed with some density in it. The players declare the prices for the goods. The customers compare the costs for a visit of each firm. The costs consist on price plus the distance from the customer to the firm. The solution of two game-theoretic problems is derived. The first problem is to find the equilibrium prices for the homogeneous goods and the second is to find the equilibrium allocation of the players.

2. **Simple bargaining problems and Shapley rule**
   Francesc Carreras, Applied Mathematics II, Technical University of Catalonia, ETSEIAT, P.O. Box 577, E-08220, Terrassa, francesc.carreras@upc.edu

The domain of the proportional rule is that of simple bargaining problems (SBPs), defined by the individual utilities and the utility of the grand coalition. The idea of ‘closure’ of a SBP leads to quasi-adaptive games and to define a Shapley rule for SBPs. Several axiomatizations are given. Among the axioms, the proportional rule fails to satisfy additivity. Although this property might seem a "mathematical delicatessen", its lack makes inconsistent the proportional rule when dealing e.g. with cost—saving related problems (SBPs), defined by the individual utilities and the utility of the grand coalition. The idea of "closure" of a SBP leads to quasi-adaptive games and to define a Shapley rule for SBPs. Several axiomatizations are given. Among the axioms, the proportional rule fails to satisfy additivity. Although this property might seem a "mathematical delicatessen", its lack makes inconsistent the proportional rule when dealing e.g. with cost—saving related problems (SBPs), defined by the individual utilities and the utility of the grand coalition. The idea of "closure" of a SBP leads to quasi-adaptive games and to define a Shapley rule for SBPs.

3. **A game theoretical model of planned behavior**
   Helena Ferreira, Rua Dr. José Sampaio nº 861, 4810-275, Guimarães, helena@safer@gmail.com, Leandro Almeida, José Cruz, Alberto A. Pinto

We introduce, in the literature, a Game Theoretical Model of Planned Behavior in which we propose Bayesian-Nash Equilibria as one, of many, possible mechanisms for transforming human intentions in behavior. This model establishes an analogy between the Theory of Planned Behavior that analyses the decision-making mechanisms of individuals and Game Theory concepts. We study the best strategic individual decision taking in account the collective response and consequently the use of a constant strategy in no sat-uration situations and splitted strategies in boredom and frustration situations.

**TF-26**

**Tuesday 16:05-17:25**

**GSI - S 35**

**Graph Algorithms I**

Stream: Discrete Optimization

**Contributed session**

Chair: Alireza Ghaffari Hadigheh, Math., Azerbaijan University of Tarbiat Moaalem, 35 Km. Tabriz-Maraghe Road- Azarbaijan University of Tarbiat Moaalem, Dept. of Mathematics, 5375171379, Tabriz, East Azerbaijan, Iran, Islamic Republic Of, hadigheha@azaruniv.edu

1. **A linear algorithm for computing the biclique cover number of a series-parallel graph**
   Victor Lepin, Institute of Mathematics, National Academy of Sciences of Belarus, 11 Surganova str, 220072, Minsk, belarus@im.bas-net.by

The biclique cover number of a graph is the minimum number of bicliques, that is, complete bipartite subgraphs, needed to cover all edges of the graph. The problem of computing the biclique cover number is NP-hard even for chordal bipartite graphs. A linear-time algorithm for computing the biclique cover number of a (simple) series-parallel graph is given.

2. **An efficient asymptotically optimal algorithm for the maximum-weight m-peripatetic salesman problem in the k-dimensional Euclidean space**
   Edward Gimadi, Discrete Analysis and Operations Research, Sobolev Institute of Mathematics, Prospekt Akad. Koptyuga, 4, 630090, Novosibirsk, Russian Federation, gimadi@math.nsc.ru

The m-Peripatetic Salesman Problem consist in finding of m edge-disjoint Hamiltonian circuits in graph with the maximum (or minimum) total weight of chosen edges. We consider the maximum-weight problem in a complete graph, where a vertex corresponds to a point, and the weight of an edge equals the length of an appropriate interval in the k-dimensional Euclidean space. Earlier the asymptotic optimality in the case of m=2 was established. In this paper we give an efficient algorithm for m≥2 and prove its asymptotic optimality. The work is supported by RFBR (projects 08-01-00516 and 07-07-00222).

3. **Semidefinite optimization approach towards domination number in graphs**
   Alireza Ghaffari Hadigheh, Math., Azerbaijan University of Tarbiat Moaalem, 35 Km. Tabriz-Maraghe Road- Azarbaijan University of Tarbiat Moaalem, Dept. of Mathematics, 5375171379, Tabriz, East Azerbaijan, Iran, Islamic Republic Of, hadigheha@azaruniv.edu, Behzad Ashayeri, Tamas Terlaky

For a given graph G = (V, E), a set S ⊆ V of vertices is called a dominating set if every vertex v ∈ V is either an element of S or is adjacent to an element of S. The domination number γ(G) of a graph G equals the cardinality of a minimal dominating set in G. Finding the domination number in general graphs are known as an NP-hard problem. Here, we present a semidefinite optimization relaxation for computing domination number of a general graph that is solvable in polynomial time.
Combinatorial Optimization

Stream: Discrete Optimization

**Contributed session**

Chair: Igor Grebennik, System engineering, Kharkov national university of radioelectronics, flat 130, Geroev Truda str, 45, 61129, Kharkov, Ukraine, grebennik@onet.com.ua

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1 - Integer partitions into arithmetic progressions

Sadek Bouroubi, Faculty of Mathematics, Dept of Operations research, USTHB University, Laboratory LAID3, BP32 Bab Ezzouar 16111, 16111, Algiers, Algeria, bouroubi@yahoo.fr, Nesrine Benyahu Tani

Every number not in the form 2k can be partitioned into two or more consecutive parts. Thomas E. Mason has shown that the number of ways in which a number n may be partitioned into consecutive parts, including the case of a single term, is the number of odd divisors of n. This result is generalized by determining the number of partitions of n into arithmetic progressions with a common difference r, including the case of a single term.

2 - Robustness tolerances for combinatorial optimization problems.

Marek Libura, Systems Research Institute, Polish Academy of Sciences, Newelska 6, 01-447, Warszawa, Poland, libura@ibspan.waw.pl

In the framework of robust optimization we consider so-called robustness tolerances, defined in analogous way as widely used tolerances of coefficients in standard sensitivity analysis. They provide maximum perturbations of single optimization problem coefficients, preserving the robustness of the solution considered. For the generic combinatorial optimization problem we give formulae for computing the robustness tolerances of all the objective function coefficients and we prove that this can be done in polynomial time whenever the optimization problem is polynomially solvable itself.

3 - Enumeration and constructive tools of generating special combinatorial sets

Igor Grebennik. System engineering, Kharkov national university of radioelectronics, flat 130, Geroev Truda str, 45, 61129, Kharkov, Ukraine, grebennik@onet.com.ua, Yuri Siyuan

The report is devoted to a problem of generating combinatorial sets of special structure. A concept of the composition k-image of combinatorial sets (the k-CICS) generated by primary combinatorial sets is proposed. Permutations, combinations and n-tuples are considered as the primary combinatorial sets. Classes of the k-CICS are defined depending on types of the primary combinatorial sets. For enumeration of the k-CICS we construct combinatorial species of each class of the k-CICS and corresponding generating series. Examples of the k-CICS and its applications are given.

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In-Store Logistics and Demand Management

Stream: Demand and Supply in Consumer Goods

**Invited session**

Chair: Heinrich Kuhn, Chair of Production Management, Catholic University of Eichstaett-Ingolstadt, Auf der Schanz 49, 85049, Ingolstadt, Germany, heinrich.kuhn@ku-eichstaett.de

1 - Listing, facing and pricing in consumer goods industry

Alexander Hübner, WFI - chair of production management Prof. Dr. Kuhn, Catholic University Eichstätt-Ingolstadt, Auf der Schanz 49, 85049, Ingolstadt. alexander_huebner@mckinsey.com, Heinrich Kuhn

The objective is to generate an optimization model which supports to define the right products to offer (“listing”), the right space to allocate (“facing”) and the right price to set for each product (“pricing”) in consumer goods industries. The profitability for producers and retailers should be maximized under limited shelf space. A literature review shows that either only models used for isolated sales effects or they are not based on real optimization. The model will be tested with real data to provide a practical tool and compare the results with other commonly used methods.

2 - Perishable inventory control under handling and storage constraints

Rob Broekmeulen, OPAC, TU Eindhoven, P.O. Box 516, Pav. E10, 5600 MB, Eindhoven, -, Netherlands, r.a.c.m.broekmeulen@tue.nl

We consider a retailer that sells perishable inventory from a capacitated storage space in the store. The customers prefer to withdraw the products Last In First Out. The supplier delivers the products to the backroom from where the products are replenished to the sales area. We investigate control policies that rely on in-store operations to reduce the effects of the withdrawal behavior on outdating by and the handling costs for the retailer.

3 - Identifying the cooperative advertising multi-player game-solution in supply chain using genetic algorithms

Chen Chieh-Bein, Logistics Management, Takming University of Science and Technology, 56, Sec. 1, Huanshan Rd., Neihu, Taipei 11451, Taiwan R. O. C., 11451, Taipei, Taiwan, ccbchen@mail.takming.edu.tw, Yuanchau Liour, Lin Chin-Tsai, Chun Hsien, Yang-Chieh Chin

Supply chain members, manufacturers and retailers, usually share common responsibility on national and local advertising for sales promotion. The primary objective of this research is to construct the mathematic models in different market response functions associated with the hierarchical Stackelberg game and then to identify its equilibrium. This research will implement a real case and its numerical results will present the cooperative advertising in Stackelberg game using intelligent genetic algorithm to solve the multi-objective and multi-disciplinary optimization problem in supply chain.
An in-depth analysis of problems resulting from not distinguishing between value and utility functions in decision making under risk is presented. First, the concepts of value and (risk) utility functions are reviewed. Afterwards, by a detailed discussion of different recent publications, it is pointed out why ignoring the difference between the concepts is problematic. It is concluded that — in order to gain valid results — it is vital to use the correct type of function in the analysis of known and in the development of new concepts, especially in descriptive decision theory.

TF-30

Nonlinear Optimization I

Stream: Engineering Optimization

Invited session

Chair: Alexander Tarakanov, Belskogo, 53-255, 220015, Minsk, alex.tarakanov@gmail.com

Jose Herskovits, COPPE, Federal University of Rio de Janeiro, Caixa Postal 68503, 21945970, Rio de Janeiro, RJ, Brazil, jose@optimize.ufrj.br

FAIPA_MDO is based on FAIPA, the Feasible Arc Interior Point Algorithm, and employs a Mathematical Programming Model that works with linking variables to introduce the interaction between disciplines. The state variables of each discipline are considered unknowns of the Mathematical Program and the state equations are included as additional equality constraints. FAIPA_MDO interacts with the Simulation Code of each of the disciplines to compute the state, the state derivatives and solve the tangent state equation. Our approach is strong and efficient for real size applications.

2 - First and second directional derivatives of value functions in nonlinear programming problems with perturbations

Alexander Tarakanov, Belskogo, 53-255, 220015, Minsk, alex.tarakanov@gmail.com

Sufficient conditions of directional differentiability of value functions were obtained in the well-known works by Demyanov, Shapiro, Bonnans, Ioffe, Auslender and Cominetti and other authors. As a rule these works investigate problems with single solutions and utilize (explicitly or implicitly) some types of Lipschitz continuity of optimal solutions. In our paper we extend the method of first-order approximations by Demyanov and Rubinov to study directional differentiability of value functions in optimization problems with non-single solutions.

3 - Handling manufacturing restrictions in sheet metal design by mixed integer programming

Ute Guenther, Mathematics, TU Darmstadt, Schloßgartenstrasse 7, 64289, Darmstadt, Germany, uguenther@mathematik.tu-darmstadt.de, Alexander Martin

We investigate an application from mechanical engineering where the aim is to find design plans for branched sheet metal structures. The problem is modeled as a directed Steiner tree with additional constraints such as on the diameter. To model all features from the engineering side we introduce new classes of variables for the tree which in return enables us to formulate connectivity constraints in a new way via facet-defining inequalities. We will also show how manufacturing restrictions for real-life examples can be handled using branch-and-cut approaches and new graph algorithms.
4 - A modified relaxation method for mathematical programs with complementarity constraints (MPCCs)

Abdeslam Kradani, Mathématiques et Informatiques, Université de Limoges, 123, Av. Albert Thomas, 87060, Limoges, abdeslam.kradani@usherbrooke.ca

In this talk, we present a modified relaxation method for solving mathematical programs with complementarity constraints (MPCCs). We show that this method has strong convergence properties. A penalty active set algorithm is proposed, which solves a sequence of relaxed penalized problems derived from MPCC. Global convergence results are deduced without assuming strict complementarity. Under very general assumptions, the algorithm can always find some point with strong or weak stationarity. Numerical results will be presented.

TF-31
Tuesday 16:05-17:25
GSI - S 34

Knowledge Discovery, Management and Optimization
Stream: Optimization and Data Mining

Invited session
Chair: Emilio Carrizosa, Estadística e Investigación Operativa, Universidad de Sevilla, Matemáticas, Reina Mercedes s/n, 41012, Sevilla, Spain, Spain, ecarrizosa@us.es

1 - Self-organizing maps for data mining

Enrique Domínguez, Dept. of Computer Science, E.T.S.I.Informática - University of Malaga, Campus Teatinos s/n, 29071, Malaga, Spain, enriqueed@lccuma.es

Self-organizing maps (SOMs) constitute an excellent tool for knowledge discovery in a data base, extraction of relevant information, detection of inherent structures in high-dimensional data and mapping these data into a two-dimensional representation space. However, one of the drawbacks arises because the network architecture has to be established in advance, and this task is usually difficult in a lot of problems of the real world due to the high dimensionality of the input data. Another drawback is the hierarchical relationships among input data.

2 - Dimensionality reduction for linear support vector machines using column generation

Richard Weber, Department of Industrial Engineering, University of Chile, Republica 701, 2777, Santiago, Chile, rweber@die.uchile.cl, Jaime Miranda

Many applications require the analysis of large data sets. Several methods exist for this task being Support Vector Machines (SVM) of particular interest from an optimization point-of-view. A major problem, however, when applying SVM is the computational time which increases exponentially with the observed data points. We present a column generation approach for linear SVM which reduces considerably computational time. The respective results show that the correct solution or a very close approximation can be obtained using very few data points thus providing fast results for large data sets.

3 - Binarized support vector machine and extensions

Belen Martin-Barragan, Dpto. Estadistica, Universidad Carlos III de Madrid, c/Madrid 126, 28903, Getafe, Madrid, Spain, belen.martin@uc3m.es, Dolores Romero Morales, Emilio Carrizosa

The interpretation ability of a data mining tool is an important factor to explain its success, as for example in algorithms as Classification and Regression Trees (CART) and Logical Analysis (LAD) of Data. Margin-based classifiers, as Support Vector Machines (SVM), have become a very powerful tool for classification and regression. However, the classifier produced by crude Support Vector Machines is not as interpretable as CART or LAD.

In this work we present various SVM-based tools for classification and regression problems where interpretability is an important issue.

TF-32
Tuesday 16:05-17:25
GSI - S 4

Data mining methodology
Stream: Data Mining

Contributed session
Chair: Davide Magatti, Department of Information, Systems and Communication, Università degli Studi di Milano Bicocca, Edificio U14, Viale Sarca 336/14, 20126, Milan, Italy, magatti@disco.unimib.it

1 - Analysing databases of quantitative and qualitative data with missing qualitative values

Fabiola Portillo, Economics and Business Administration, Universidad de La Rioja, Edificio Quintiliano, C/ Ciguenza 60, 26004, LOGRÓÑO, La Rioja, fabiola.portillo@unirioja.es, Cecilio Mar-molinerro

The analysis of databases with qualitative and quantitative data is complex. A new procedure was applied for the estimation of qualitative missing values: we first applied optimal scaling (OS) to complete data; next, correlations between variables were studied; third, the relationships between variables were explored using Path Analysis; and, finally, a homogeneity analysis based procedure was followed in order to obtain the imputations that were used in the final OS analysis. The OS analysis was performed a second time, and the results were interpreted using CATPCA and Property Fitting.

2 - Hierarchical topic extraction

Davide Magatti, Department of Information, Systems and Communication, Università degli Studi di Milano Bicocca, Edificio U14, Viale Sarca 336/14, 20126, Milan, Italy, magatti@disco.unimib.it, Fabio Stella

Topic Extraction (TE) is a form of document clustering and organization which has become particularly important in the last years. Starting from a documents corpus, TE is concerned with the problem of discovering which are the mentioned topics. In this talk the authors extend topic extraction by allowing topics to be organized according to an unknown hierarchy. A quantitative model to infer the topics hierarchy is described and the corresponding learning algorithm is presented. The proposed approach is supported by a set of numerical experiments.

3 - Misclassification probability bounds in multinomial case

Victor Nedelko, Siberian Branch of Russian Academy of Science, Institute of Mathematics, Zolotodolsinskaya 29-315, 630090, Novosibirsk, nedelko@math.nsc.ru

A problem of construction bounds for misclassification probability is considered for the multinomial case with one discrete variable given. The bounds are constructed as functions of certain statistics such as empirical risk (resubstitution error) or leave-one-out misclassification rate. Some properties of these statistics were investigated, namely the highest possible bias of empirical risk was obtained and the distribution that provides such bias was found. Effectiveness of leave-one-out and empirical risk statistics was also compared.
4 - Specification of rank scaled expert estimations using measured data
Anton Strizhov, Faculty of Mechanics and Mathematics, Lomonosov Moscow State University, Klara Zetkin 13-79A, 127299, Moscow, anton.strizhov@gmail.com, Vadim Strijov

One has to find linear-scaled estimations of integral indicators which does not contradict expert estimations. Rank-scaled expert estimations of objects quality and features importance together with measured data table are given. Rank estimations define a polyhedral cone of weights and a cone of indicators. The linear operator maps the cone of weights to a cone in the space of indicators. If this cone intersects the cone of indicators, then the required estimations belongs to this intersection. Otherwise, we must find a compromise between the specified and mapped estimations.

TF-33
Tuesday 16:05-17:25
GSI - S 7

Economic Modelling
Stream: Linear Optimization
Contributed session
Chair: Nicolas Omont, Artelys, 12 rue du 4 septembre, 75002, Paris, nicolas.omont@artelys.com

1 - Multilateralism and regionalism — statistical relationship
Eva Cihelkova, Department of World Economy, University of Economics, Prague, Winstona Churchilla 4, 130 67, Prague 3, Czech Republic, cihelka@vse.cz

The paper describes the mutual relationship between multilateralism and regionalism using the tools of statistical approaches. The mathematical model is created, which serves as a basis for a further study of the mutual relationship of both tendencies by empirical analyses and regression analyses. The variables characterizing preferential against non-preferential tariffs are used to verify a mutual support/concurrence of relations in question. The results allowed to characterize the mutual relationship of both tendencies authoritatively. Prepared under GA 402/07/0049, 402/09/0273.

2 - National economy challenges in croatia within global crisis environment
Elza Jurun, Faculty of Economics, University of Split, Department of Quantitative Methods in Economics, Matic Hrvatske 31, 21000, Split, Croatia, elza@efst.hr, Josip Arneric, Lana Kordic

This paper is a part of an extensive scientific research about modern trends in Croatian national economy within environment of global crisis. For this purpose real retail trade turnover, average monthly real wages and household loans are chosen for multiple econometric analysis. Original national statistics data of retail trade turnover were deflated using consumer price indices and index of seasonally adjustment of its contemporary behavior was provided. The modeling is based on the real Croatian national economy time-series.

3 - Towards electricity transmission tariffs based on long term marginal pricing
Nicolas Omont, Artelys, 12 rue du 4 septembre, 75002, Paris, nicolas.omont@artelys.com, Jérôme Dejaegher, Arnaud Renaud

Electricity transmission prices impacts two different objectives: ensuring economic sustainability (cost recovery) and sending incentives to actors to adjust their production/consumption level (overall efficiency of the system).

We propose a methodology to build temporally and spatially differentiated tariffs that send incentives to producers and consumers in order to reach an optimal social surplus while ensuring cost recovery. This methodology is based on long term marginal prices derived from a neoclassical economic equilibrium.

4 - Efficiency of fdi inflows supporting gdp. central European economies.
Vaclava Pankova, Dept. of Econometrics, University of Economics Prague, W.Churchill sq. 4, 13067, Prague 3, Czech Republic, PANKOVA@VSE.CZ, Roman Husck

Relationship between FDI and GDP of middle European new EU members, compared to Austria, is studied by the help of panel data techniques. Two approaches are applied. (1) VAR model looking for causality between both entities, (2) efficiency measurement of influence of FDI on GDP. Evidence of a relationship between FDI and level of capital is strong, relevancy of labor productivity to FDI inflows is not confirmed. The results found show that in the followed region FDI support an economic growth and vice versa. Prepared under GACR 402/07/0049, 402/09/0273.

TF-34
Tuesday 16:05-17:25
GSI - S 8

Business Rules: Extraction, Modelling and Integration
Stream: Applications in Business Intelligence and Knowledge Discovery
Invited session
Chair: Jose C. Gonzalez, DAEDALUS, S.A., Avda. Albufera 321, 28031, Madrid, Spain, jgonzalez@daedalus.es

1 - Extraction of business rule from unstructured text
Thierry Declerck, Language Technology Lab, DFKI, Stuhlsatzenhausweg, 3, D-66123, Saarbrücken, Germany, declerck@dlki.de

We present a strategy for extracting business rules from unstructured text. For this we submit regulatory texts to a parser, which detects and marks syntactic constitute structures (words, phrases, clauses and sentences) and dependency relations in the input. "Dependency" is about relations between the identified syntactic constituents on the base of grammatical functions played by the constituents in relation to each other within the larger constituent they are embedded in. Those relations are mapped onto a formal representation language, in which Business Rules can be expressed.

2 - Harnessing business rules in software development processes
Jose C. Gonzalez, DAEDALUS, S.A., Avda. Albufera 321, 28031, Madrid, Spain, jgonzalez@daedalus.es, José Luis Martinez-Fernández, Paloma Martinez

This contribution describes an approach to support business rules design and development, assuring an easy integration in the software development process. When there is a need to introduce decision support in Information Technology systems, Business Rules are a good alternative. Two main goals are pursued: 1. Business Rules should be defined in an independent way. e. the definition should be valid for any BRE considered 2. The tasks related to the definition and management of new Business Rules should be easily integrated in the software development process implemented in an organization.
3 - Protune: rule based policies on the semantic web
Daniel Olmedilla, Telefonica R&D, Emilio Vargas 6, E28043, Madrid, danieloc@tid.es
This talk will present part of the work performed within the EU REWERSE Network of Excellence (Reasoning on the Web with Rules and Semantics) and in particular the Protune policy framework (www.l3s.de/web/protune). The work performed in the Protune framework offers a high flexibility for specifying any kind of policy, offers mechanisms to write policies in a controlled natural language, and integrates external systems such as relational databases at the policy level. It also provides facilities for increasing user awareness such as explanations of the policies in natural language.

4 - Success monitoring in transportation
Heribert Kirschfink, momatec GmbH, Weiern 171, 52076, Aachen, heribert.kirschfink@momatec.de
Transportation networks have the goal to ensure mobility. This means to serve transport demand under the constraint of ensuring traffic safety. To reach that goal, capacity bottlenecks caused by high demand, incidents and ‘planned’ capacity bottlenecks like road work have to be managed. In particular road work may cause conflicts for the network operator as cost of maintenance correlate with traffic flow quality. So, characteristic figures for mobility services, the value of the network and the performance of the underlying processes are needed to monitor and control the economic success.

TF-35
Tuesday 16:05-17:25
GSI - S 9
Commodity Prices and Procurement
Stream: Value and Risk in Incomplete Markets
Invited session
Chair: Peter Kelle, ISDS, Louisiana State University, CEEA, 70810, Baton Rouge, Louisiana, United States, qmkell@lsu.edu
Chair: Martin Rainer, ENAMEC, Glockengasse 15, D-97070 Würzburg, 97070, Würzburg, Germany, martin.rainer@enamec.de
1 - The framework for evaluation of the communication bandwidth market models
Wojciech Stanczuk, Institute of Telecommunications, Warsaw University of Technology, ul. Nowowiejska 15/19, Warszawa, 00-665, Warszawa, w.stanczuk@tele.pw.edu.pl, Piotr Palka, Jozef Lubacz, Eugeniusz Toczyłowski
The paper presents the framework for studying and analyzing the properties of market models for bandwidth allocation in communication networks - the family of Balancing Communication Bandwidth Trade models, combinatorial auction based c-SeBiDA model etc. A set of bandwidth allocation indicators defined for comparing test results is described. Network topologies for test cases come from the SNDLib database. Buy and sell offers are generated according to assumed market conditions. Test cases are modeled in the XML-based Multicommodity Market Model. Some examples of test results are presented.
2 - A combined capacity reservation and spot market procurement policy under stochastic demand and spot-market price uncertainty
Karl In der Furth, Faculty of Economics and Management, Otto-von-Guericke University of Magdeburg, Universitätsplatz 2, 39106, Magdeburg, Germany, indferfurth@ww.uni-magdeburg.de, Peter Kelle
In an inventory system with uncertain demand the cost-effective management of the combined use of a short-term (spot-market with a random spot-market price) and long-term procurement option (wholesale price contract with a capacity reservation level) is considered. The task is to fix a long-term capacity reservation level and to decide period-by-period on how to combine the two supply options. Analytical results are developed for a simple two-parameter base stock policy. It is investigated how capacity reservation and sourcing decisions depend on the level of both demand and price uncertainty.

TF-36
Tuesday 16:05-17:25
GSI - S 11
Stochastic Modelling 3
Stream: Stochastic Modelling
Contributed session
Chair: Frank Beichelt, School of Statistics and Actuarial Science, University of the Witwatersrand, Private Bag 3, WITS 2050, 2050, Johannesburg, South Africa, Frank.Beichelt@wits.ac.za
1 - Ordering of utility functions of weighted random variables and its financial application.
Elena Almaraz Luengo, Estadística e Investigación Operativa, Facultad de Ciencias Matemáticas, U.C.M., Plaza de Ciencias, 3, 28040, Madrid, Spain, ealmarazluengo@mat.ucm.es
It’s established order relations between particularly utility functions applied to random weighted variables(rvw), knowing the existing relations between the original random variables(rv) from which we’ve built the rwv. The utility functions we used are based in the mean of the rv and in another risk measure different from the variance, because the use of this last caused inconsistency with the stochastic dominance rules. The results obtained have applications in assets selection and we pretend to generalize these results to obtain the efficient portfolio in continuous time.
2 - Benefits of partial product flexibility
Ashis Chatterjee, Operations Management, Indian Institute of Management Calcutta, Indian Institute of Management Calcutta, D.H.Road, Joka, Kolkata-700104, 700104, Kolkata, West Bengal, India, ac@iimcal.ac.in, Dipankar Bose
In this paper, we develop a single period model for multi-product-multi-plant scenario to determine the plant capacities and the product-plant assignments that optimize expected profit under demand uncertainty. Due to analytical intractability, simulated data based optimization has been used for the purpose of the solution. The solutions give insights on the economics of product flexibility. Specifically, conditions under which investment in partial flexibility may be a better strategy have been examined under various levels of demand uncertainty and correlation of demand among products.

3 - Maximal system availability under cost restrictions
Frank Beichelt, School of Statistics and Actuarial Science, University of the Witwatersrand, Private Bag 3, WITS 2050, 2050, Johannesburg, South Africa, Frank.Beichelt@wits.ac.za

Repair cost limit replacement policies are user-friendly maintenance policies for a wide variety of technical systems. So far their analysis has been restricted to the application of constant repair cost limits and the minimization of the maintenance cost rate. The talk investigates the effect of age-dependent repair cost limits and age-dependent repair costs on the system availability. Under the assumptions made it is shown that the application of decreasing repair cost limits is more efficient than applying a constant repair cost limit.

TF-37
Tuesday 16:05-17:25
GSI - S 12
Strategic Planning and Management

Contributed session
Chair: Jin Young Choi, 134 Shinchon-dong, Seodaemun-Gu, 120-749, Seoul, Korea, Republic Of, gksniper@naver.com

1 - Improving the alignment of strategic objectives in the outsourced projects management
Edilson Giffhorn, Production Engineering, Santa Catarina Federal University, Rod. Amaro Antônio Vieira, 655, apt. 106-E, Bairro Itacorubi, 88034-101, Florianópolis, Santa Catarina, Brazil, edilson.giffhorn@gmail.com, William Vianna, Leonardo Ensslin, Sandra Ensslin, Rogerio Lacerda

This paper presents a research developed in a Brazilian telecom system operator and aims to build a personalized performance assessment model. The intervention instrument used was the MCDA-C. The built model made possible:1)to align the strategic objectives;2)to measure and to compare the performance of the companies;3)to have a process for monitoring and improvement of the outsourced companies. As result, the decision-maker become to have a management practice, consistent and scientifically well-founded that allows disseminating to outsourced companies how to improve their performance.

2 - Multi-objective optimization for planning of central it resources with focus on green it
Marc Klages, Universität Hannover, Institut für Wirtschaftsinformatik, Königsworther PLatz 1, 30167, Hannover, klages@iwi.uni-hannover.de, Hans-Jörg von Mettenheim, Michael H. Breitner

Recently, an additional variable is introduced when planning central IT resources: ecologically sound purchases. With the ongoing internalization of ecological costs we need a framework to provide the ground for economically viable solutions. Using multi-objective optimization we provide a reference model for optimization of capacity dependent electricity consumption in clusters and grid computers. Two case-studies conclude our research: Optimizing a cluster of CPUs which allow load based deactivation of cores and optimizing the decision of choosing between fat and thin client architecture.

3 - A decision-analytic approach to blue-ocean strategy development
Thorsten Staak, Department of Economics, Otto-von-Guericke University, Postfach 4120, 39016, Magdeburg, Germany, thorsten.staak@ovgu.de, Matthias Raith, Helge Wilker

The ‘Blue Ocean’ strategy development approach (Kim, Mauborgne 2005) is based on the realization that it is much more valuable to find uncontested market space than to compete against incumbent firms. The main instrument used is the strategy canvas, a visual depiction of strategy profiles. The approach leaves unclear how a blue-ocean strategy is recognized among multiple alternatives. Therefore, we consider the selection of a strategy profile as a multi-attribute decision problem. This decision-analytic approach allows the entrepreneur to quantitatively derive the optimal market strategy.

4 - Developing the tradeoff between personal fulfillment and competitiveness in venture creation
Simon Halberstadt, Lehrstuhl für Entrepreneurship, Otto-von-Guericke Universität Magdeburg, Postfach 4120, 39016, Magdeburg, Sachsen-Anhalt, Germany, simon.halberstadt@ovgu.de, Matthias Raith, Thomas Zomack

Venture creation is usually associated with an entrepreneur’s opportunity of achieving personal fulfillment. In reality many nascent entrepreneurs discover that much of their vision is sacrificed in the process of creating a startup. We address the conflict between personal fulfillment and the startup’s competitiveness from a negotiation-analytic perspective. We show how the conflict is transformed in the planning process, and demonstrate how a purely market-oriented focus on expansion serves to enhance personal fulfillment. Finally, we discuss practical implications for business development.

TF-38
Tuesday 16:05-17:25
GSI - S 13
Strategic optimization in supply chains and risk management II

Invited session
Chair: Cedric Yiu, Applied Mathematics, The Hong Kong Polytechnic University, Hunghom, -,-, Kowloon, macyiu@polyu.edu.hk

1 - Optimal inventory strategies with fixed order cost under value-at-risk constraint
Shuoyu Wang, Industrial and Manufacturing Systems Engineering, The University of Hong Kong, Pokfulam, -,-, Hong Kong, Hong Kong, wsyu@hkusua.hku.hk, Cedric Yiu, KI Mak

This paper reveals that the optimal inventory strategy with fixed order cost under value at risk constraint may be obtained by solving a linear programming problem.
The underlying idea of this paper is to consider the raw material inventories of a manufacture as a part of joint inventory and financial risk management. A portfolio consisting of the risky raw material inventory and the risk free bank account is studied and the VaR of the portfolio is analyzed and imposed as a risk control constraint. The objective function is to maximize the utility of total portfolio value. In this model, the ordering cost is assumed to be fixed and the selling cost is proportional to the value.

2 - Risk constrained optimal portfolios with jumps
Cedric Yiu, Applied Mathematics, The Hong Kong Polytechnic University, Hunghong, -., Kowloon, macyiu@polyu.edu.hk, Jingzhen Liu

In this paper, we impose the VaR as a dynamic constraint to the optimal portfolio problem with jumps. At each instant, the VaR is estimated and is applied to influence the investment decision. The optimal portfolio problem is formulated as a constrained maximization of the expected utility, with the constraint being the VaR level. Dynamic programming is applied to reduce the whole problem to solving the Hamilton-Jacobi-Bellman equation coupled with the VaR constraint, and the method of Lagrange multiplier is then applied to handle the constraint. A numerical method is proposed.

3 - Optimal policy for an insurer via martingale methods
Jingzhen Liu, Applied Mathematics, The Hong Kong Polytechnic University, Hunghong, -, Kowloon, Hong Kong, 06902020r@polyu.edu.hk, Cedric Yiu

In this paper, the optimal investment and proportional reinsurance policy are considered with the objective to increase the expected utility for the terminal wealth. The mathematical model of the surplus process is developed and the problem is formulated as a stochastic optimal control. By using martingale methods, this stochastic optimal control problem is reduced to solving a deterministic optimal control problem. Several numerical methods are then applied to handle the numerical problem. A numerical method is proposed.

4 - Integrated design in service support supply chains
Alexander Richter, Business Administration and Production Management, Ruhr University Bochum, Universitätsstraße 150, 44801, Bochum, Germany, alexander.richter@rub.de, Marion Steven

This paper focuses on the design of a product-service system which consists of customized configurations of product and service parts tailor-made to meet individual customer needs. These product and service parts exert a mutual influence on each other, owing to an integrated development and operation. By following such customer-oriented strategies the service support supply chain needs to be reshaped, striving at reallocating risks and incentives. In an incomplete contract framework, we analyze the design of both Industrial Product-Service Systems, the supply chain, and their interrelation.

2 - Optimizing systems performance exploring the timed state space of coloured petri nets
Miguel A. Mujica, Telecommunications and Engineering Systems, Universitat Autonoma de Barcelona, campus univ edif q, bellaterra, 08193, barcelon, Spain, el_mota2000@yahoo.com.mx, Miquel Angel Pera

Coloured Petri Nets is a formalism which has been used for validation and verification of systems. One tool used for these purposes is the reachability tree which is a graph that stores all the states of the model. In systems performance studies, an attachment of time characteristics must be done to the model. State Explosion is a problem in state space analysis making some problems intractable due to the size of the state space. It is presented an approach which deals with T-State Spaces and selects the best paths based in time analysis avoiding the exploration of the whole T-State Space.

3 - Simulating normative behaviour and norm formation processes
Ulf Lotzmann, Institute of Information Systems Research, University of Koblenz-Landau, Universitätsstr. 1, 56070, Koblenz, ulf@uni-koblenz.de

We describe the design of an agent-based model for simulating normative behaviour and norm formation processes, grounded in a scientific theory of norm innovation (EU-Project EMIL - Emerge In The Loop). Based on a message concept, the behavior of an agent is influenced by events perceived from concrete actions in a given scenario as well as by the valuation of events received from other agents related to performed actions. The evaluation of these different event types triggers a norm formation and learning process and determines the normative behavior of agents.
1 - Simulated decision learning in a multiactor setting
Viveca Asproth, Information Technology and Media, Mid Sweden University, 83125, Östersund, Sweden, viveca.asproth@miun.se, Stig C Holmberg
The idea of decision analysis — and subsequent learning from the outcomes — is old within OR. Here this approach to continuous improvement of decision outcomes is put one step further within the area of crisis and disaster management. This is done by introducing multiactors making simultaneous decisions with just partial information about each other. Further, decision outcomes are achieved from a simulation model rather than from the real object system.

2 - Modelling and simulation for training of disaster management
Andrej Skraba, Faculty of Organizational Sciences, University of Maribor, Kidriceva cesta 55a, 4000, Kranj, Slovenia, Slovenia, andrej.skraba@fov.uni-mb.si, Miroljub Kljajic
Proposed paper will address development of a modular immersive simulation platform, which can be used by trainers to introduce unexpected impacts within the scenario. Effective training systems for crisis managers are necessary to provide decision support during relief operation following security incidents on critical trans European transport networks. Development of new interactive simulation systems capable to provide large-scale simulations of inter-modal traffic and emergency units that can dynamically adjust to events introduced in real-time by operators will be described.

3 - Disaster management simulation debriefing: a prototypical integrated statistical analysis tool
Knut Ekker, Information Technology, Nord-Trøndelag University College, PO box 2501, 7729, Steinkjer, Norway, knut.ekker@hint.no
This paper explores the use of an open source statistical tool integrated in a disaster management simulation. The purpose of the integrated tool is to provide an on-the-fly analysis of simulation data for the debriefing session immediately following a disaster management simulation. A prototype of such a tool will be developed and tested with computer generated data on communication among simulation participants, media handling agility of the participants as well as individual and organisational learning effects.

TF-41
EURO 23 - Bonn 2009

1 - Simulated decision learning in a multiactor setting
Viveca Asproth, Information Technology and Media, Mid Sweden University, 83125, Östersund, Sweden, viveca.asproth@miun.se, Stig C Holmberg
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TF-42
EURO 23 - Bonn 2009

1 - Economic modelling of optimal investment into long-term redevelopment in disaster-impacted regions
Natali Hritonenko, Mathematics, Prairie View A&M University, PO Box 0519, 77446, Prairie View, TX, nahritonenko@pvamu.edu, Yuri Yatsenko
A vintage capital model is used to describe the investment into new capital, infrastructure and migration with goals of creating disaster—resilient regional economy. A natural disaster is depicted as a sharp decrease of capital assets which causes a deviation of optimal trajectory from a balanced growth path to capital short-age and higher unemployment area. Such perturbations are similar to technological shocks in labour-saving technical change. Anticipation effects are discussed. Analysis reveals new general strategies to develop a disaster—resilient economy of the impacted region.
2 - Maintenance and investment in an optimal growth vintage capital model

Raouf Boucekkine, Université catholique de Louvain, B-1348, Louvain-La-Neuve, Belgium, Raouf.Boucekkine@uclouvain.be, Fausto Gozzi, Giorgio Fabbri

In a vintage capital framework, we postulate that once machines installed, firms devote resources to keep them operational over time. Machines are kept until this maintenance cost exceeds productivity. Within an optimal control set-up, we determine the properties of optimal investment and maintenance paths. Since the optimal lifetime of machines is finite, we deal with an optimal control of a differential-difference equation, yielding an infinite dimensional problem. We end up applying an appropriate dynamic programming approach. Optimal dynamics are studied numerically.

3 - Forest management for timber and carbon in the presence of climate changes

Renan Goetz, Department of Economics, University of Girona, Campus Montilivi, s/n, 17071, Girona, Spain, renan.goetz@udg.edu, Natali Hritonenko, Rubén Javier Mur Toro, Yuri Yatsenko, Ángels Xabadia

This paper analyzes the optimal forest management for timber and carbon sequestration. It employs a distributed opt. control model based on a partial integral-differential equation. It examines the effects of rising carbon prices and incorporates the effect of different climate change scenarios on forest growth. Maybe these aspects have received little attention as it requires a complete integration of the biophysical and economic model. Evaluating the principal valuation methods for carbon sequestration shows that one of them is only correct if the growth rate is equal to the discount rate.

4 - Managing level of vendor-managed inventory with manufacturer’s warehouse capacity constraint

Wenyih Lee, Department of Business Administration, Chang Gung University, 259 Weihua 1st Rd., Kweishan, 333, Taoyuan, Taiwan, leewe@mail.cgu.edu.tw, Sheng-Pen Wang

We consider a single-supplier, single-buyer vendor-managed inventory problem. An integrated inventory control model, making joint economic lot sizes of the manufacturer’s production batch and the replenishment lot, subject to manufacturer’s warehouse space capacity constraint, is constructed to minimize the system total cost. The model developed is a general model from which known results in specific cases can be deduced. The characteristics of the model and the impact of warehouse capacity on the system total cost, production batch, and replenishment lot sizes are also discussed.

2 - Discrete vs. continuous simulation: when does it matter?

Onur Ozgün, Industrial Engineering Dept., Bogazici University, Bebek, 34342, Istanbul, Turkey, onur.ozgun@boun.edu.tr, Yaman Barlas

This study shows the similarities & differences between discrete event simulation and continuous simulation modeling. A simple M/M/2 queuing system with crowd-dependent arrival rate is used. In the first part, arrival rate decreases instantly as the number of people in system rises. In the second part, number in system affects the arrival rate first with continuous then with discrete delay. Discrete and continuous simulations give very similar results in terms of behaviors. Increasing proportionately all parameters reduces the discreteness of the system, bringing two simulation results closer.

3 - On the necessity of quantitative strategy evaluation in combating industrial counterfeiting and product piracy, a system dynamics approach.

Oliver Kleine, Industry and Service Innovations, Fraunhofer Institut for Systems and Innovation Research, Breslauer Straße 48, 76139, Karlsruhe, Germany, oliver.kleine@isi.fraunhofer.de, Marcus Schröter

Counterfeiting and product piracy are not just an issue for the consumer goods industry, but have become an increasing malady for capital goods manufactures as well. However, recent research in Germany indicates that decision makers have not yet been enabled to fully understand the scope and underlying dynamic complexity of that particular business risk. They are in need of appropriate decision support tools. Therefore, the paper investigates the potential contribution of structural theory in this respect, presents a preliminary system dynamics model and evaluates some basic strategic options.

4 - Model-based management (mbm): a research agenda

Stefan Groesser, Institute of Management, University of St. Gallen, Dufourstrasse 40a, 9000, St. Gallen, Switzerland, stefan.groesser@web.de, Markus Schwaninger

The paper’s aim is to highlight the importance of qualitative and quantitative models for management and to propose a research agenda for the topic of model-based management. This way, a contribution to the use of models for higher managerial effectiveness should be made. The role of models for managerial purposes has been under-researched and often misunderstood. In this paper, an analysis of the concept, role and function of models in the context of management and organization is undertaken. Both theory and practice can benefit from the envisaged research.
Migration, Education and Sustainable Development 3
Stream: Migration, Education and Sustainable Development
Invited session
Chair: Gerhard-Wilhelm Weber, Institute of Applied Mathematics, Middle East Technical University, ODTÜ, 06531, Ankara, Turkey, gweber@metu.edu.tr
Chair: Hanife Akar, Department of Educational Sciences, Middle East Technical University, Orta Dogu Teknik Universitesi, Egitim Fakultesi EF 316, 06531, Ankara, Turkey, hanif@metu.edu.tr

1 - Applying linear response surface analysis to investigate the effects of telecommunication proliferation and other factors on economic growth and social benefits
Zenko Polite Ncube, Computer Science & Information Systems, North-West University, Private Bag X6001, 08005, Potchefstroom, South Africa, ncubezp@nwu.ac.za, Giel Hattingh, Albert Heiberg

The rapid advances made in telecommunication and mobile phone technology have made developing nations feel that these technologies can offer them untold benefits in the areas of economic growth and social development. In this research we focus on models suggested in the literature that relate some attributes of growth in a country to factors like telecommunications proliferation, regulatory policies, etc. The use of regression modelling and interpretative techniques like linear response analysis is considered. Empirical analysis based on data from the World Bank, ITU, etc are presented.

2 - An optimization model to site solar and wind generators in a village electrification project
Laia Ferrer-Martí, IOC, UPC, Av. Diagonal 647, pav F, planta 0, 08028, Barcelona, Spain, laia.barrera@upc.edu, Rafael Pastor

Isolated electrification systems that use renewable energy are a suitable option to provide electricity to rural villages in development countries. This work presents a mixed and integer linear programming (MILP) model to design an electrification project that uses solar and microwind generators. The model considers the location of the demand points, the detailed map of the wind potential of the village and the use of microgrids. Comparing with real cases implemented in Peru, the solutions obtained with this model reduce the initial investment costs and produce significantly more energy.

3 - Coordination of collaborative development processes
Kerstin Schmidt, Institute of Automotive Management and Production Technology, Technische Universität Braunschweig, Katharinenstraße 3, 38106, Braunschweig, Germany, kerstin.schmidt@tu-bs.de, Grit Walther, Thomas Spengler, Rolf Ernst

Current development processes, e.g. of complex embedded systems for automobile electronics, are often conducted corporately by various partners. If inappropriate contract structures are used within such collaborations, inefficiencies in the design process as well as in the technical configurations of the embedded system occur due to uncertainties and differing objectives of the partners. Hence, different kinds of contracts are analyzed with regard to their coordination capability in collaborative development processes and applied to a case study.

Ethics and OR II
Stream: OR and Ethics
Invited session
Chair: Fred Wenstøp, Strategy and Logistics, Norwegian School of Management BI, Nydalsveien 37, 0484, Oslo, Norway, fred.wenstop@bi.no

1 - Ethical values beyond the objective function: towards a theory of behavioral OR/MS
Marc Le Menestrel, Department of Economics and Business, University Pompeu Fabra, Ramon Trias Fargas 25-27, 08005, Barcelona, Spain, marc.lenestrel@upf.edu, Luk Van Wassenhove

We propose theoretical foundations for OR/MS models that combine an objective function with a behavioral biasing factor. The objective function links with standard models of operations research based on the maximization of the value of the alternatives of choice. The biasing factor reflects the extent to which observation of behavior departs from the maximization of such objective function. It can be interpreted as reflecting ethical values, i.e. values that are not necessarily reducible to the value of the alternatives but pertain to the subject who is carrying out the choice.

2 - Janus-faced moral mathematics
Haavard Koppang, Gimle Terrasse 3, 0264, Oslo, Norway, haavard.koppang@bi.no, Fred Wenstøp

We focus on ethical principles and consequences, starting with a version of the self-interest theory via Parfit’s story of the man stranded in the desert, by claiming a conflict between myopic self-interest and altruism. Yet, in game theory the parties behave according to a broader version the self-interest theory, knowing that consequences depend on the choice of the other, and thus self-interest requires altruism. Even ethical principles might be adapted to self-interest through persuasive language. We claim that it is rational to combine different perspectives to guide ethical behavior.

3 - Facts, values and the rules of institutionalised dialogue
Emmanuel Picavet, Philosophy (UFR 10), Université Paris-1 Panthéon-Sorbonne, 17 rue de la Sorbonne, 75005, Paris, France, France, Emmanuel.Picavet@univ-paris1.fr

Institutionalised dialogue processes and ethical argument have become crucial to sustainable policies and regulatory frameworks in the medical sciences and medical practice. Special attention will be paid to the current process of the “États-Généraux de la bio-éthique” in France, 2009. We focus on the following features: (1) The emergence of the rules of dialogue and social capacities in dialogue; (2) the use of information and expertise in deliberative processes of this kind. We’ll argue that these issues are pivotal for normative advice about the institutional design of such debates.

4 - OR and ethics — development trends 1966 — 2009
Fred Wenstøp, Strategy and Logistics, Norwegian School of Management BI, Nydalsveien 37, 0484, Oslo, Norway, fred.wenstop@bi.no

The paper tracks development trends in the literature on OR and ethics from Kenneth Boulding’s vision in 1966 of OR as a future tool for benevolent decision making where the needs of all stakeholders are taken into account to today’s mature papers in special issues of OMEGA and ITOR. Four main themes seem to emerge: 1) Guidelines for the practice of OR, 2) How OR can be applied for good purposes, 3) Whether OR and ethics should be separated or integrated, 4) Ethical processes.
Tuesday 17:40-18:25

**TG-01**

**Tuesday 17:40-18:25**  
**Beethoven**

**Optimization Modeling in Practice III**  
Stream: OR Applications in Industry  
*Invited session*

Chair: Bjarni Kristjansson, Maximal Software, Ltd., Boundary House, Boston Road, W7 2QE, London, Iceland, bjarni@maximalsoftware.com

1 - **Roadef/euro challenge 2010: a large scale energy management problem with diversified constraints, proposed by edf**

Christian Artigues, LAAS, CNRS, 7 avenue du Colonel Roche, 31077, Toulouse Cedex 4, artigues@laas.fr, Eric Bourreau, Guillaume Dereu

The French OR Society (ROADEF) along with EURO, organizes periodically an OR challenge dedicated to industrial applications. This year, the challenge subject will be proposed by industrial partner (EDF) and will concern a large-scale energy management problem with diversified constraints. The challenge is open to everyone, and particularly to young researchers. The challenge problem will be presented during EURO 2009 and the results will be announced at EURO 2010 in Lisbon. A prize of 10000 Euros will be awarded to the best teams. Contact: challenge@roadef.org / challenge.roadef.org

2 - **Comparing the practice of OR in the private and not-for-profit sectors**

Peter Bell, Richard Ivey School of Business, University of Western Ontario, N6A 3K7, London, Ontario, Canada, pbell@ivey.ca

We have conducted a longitudinal study of more than 100 important OR applications documenting the history of these works for many years. In this presentation we discuss our findings on the practice of OR in the private sector, the military, government, and in other not-for-profits. The not-for-profit sector has been an important consumer of OR work, but our comparison of the practice of OR across sectors suggests that, with a few exceptions (some military and a few other special projects), this sector has not done as well with OR as the corporate world.

**TG-02**

**Tuesday 17:40-18:25**  
**Schumann**

**Collaborative Transportation Planning II**  
Stream: Transportation Planning  
*Invited session*

Chair: Giselher Pankratz, Dept. of Information Systems, FernUniversität - University of Hagen, Profilstrasse 8, 58084, Hagen, Germany, giselher.pankratz@fernuni-hagen.de

1 - **Collaborative vehicle routing in less-than-truckload networks**

Julia Rieck, Department for Operations Research, Clausthal University of Technology, Julius-Albert-Str.
1 - Developing a ring-based optical network structure - a case study

Silvia Schwarze, Institute of Information Systems, University of Hamburg, Von-Melle-Park 5, 20146, Hamburg, Germany, schwarze@econ.uni-hamburg.de, Marco Caserta, Matthias Frické, Stefan Voss

We consider structural properties of optical networks. It is common that 1+1 protection is required in telecommunication applications. That is, for each origin-destination-pair, two node-disjoint paths have to be established. This property is naturally ensured by ring structures and we address the questions of how to design ring networks and if they show a good behavior in terms of hardware and handling costs. We present ongoing research based on a case study with Deutsche Telekom. Within this study, we have applied ring generation and ring selection as well as interrings traffic approaches.

2 - A taxonomy of multicommodity flow and related multicut models

Eric Gourdin, DAC/OAT, France Telecom R&D, 38, rue du General Leclerc, 92794, Issy-les-Mx Cedex 9, France, eric.gourdin@orange-ftgroup.com

The Maximum Multicommodity Flow (MMF) and Maximum Concurrent Flow (MCF) problems have been considerably studied with a primal-dual perspective: the Minimum Multicut problem and the Sparsest Cut problem are weak duals of MMF and MCF. Based on these duality results, many approximation results have been derived for both problems.

In this talk, we will show that similar primal/dual relations can be derived for many other multicommodity flow problems. We will also provide valid Mixed Integer models for the new (multi-)cut problems and show how some approximation results can be extended.

TG-03

Tuesday 17:40-18:25

Reger

Wireless ad hoc networks

Stream: Network Optimization

Invited session

Chair: Mohamed Saad, Electrical and Computer Engineering, University of Sharjah, P.O. Box 27272, 27272, Sharjah, msaad@sharjah.ac.ae

1 - Gateway discovery for ad hoc nodes

Adel-aissanou Karima, Laboratory of modelisation and optimisation of systems, Laboratoire LAMOS, Université de Béjaia, targa ouzamour, 06000 bëjaia algérie, 06000, bejaia, Algeria, ak_adel@yahoo.fr, Djamil Aissani

Wireless Ad Hoc networks are becoming ideals to get an internet connection. If an ad hoc node has an Internet connection, it is interesting that this node offers the connection to others nodes which by becoming a gateway. In this paper, we present an algorithm for gateway discovery in Ad Hoc networks. To discover a gateway to the fixed network, the mobile node must ask its cluster-head and this one gives a solicitation message to the gateway. The performance of our algorithm is compared to the well known methods using NS-2 simulations.

TG-04

Tuesday 17:40-18:25

Liszt

Network design 2

Stream: Network Optimization

Invited session

Chair: Eric Gourdin, DAC/OAT, France Telecom R&D, 38, rue du General Leclerc, 92794, Issy-les-Mx Cedex 9, France, eric.gourdin@orange-ftgroup.com

This study described a hybrid model for supporting the personnel selection process in manufacturing systems. Personnel selection is a very important issue for an effective manufacturing system, since the improper personnel might cause many problems affecting productivity, precision, flexibility and quality of the products negatively. Selecting the best personnel among many alternatives is a multi-criteria decision making problem. In this study, a hybrid model which employs analytic network process and fuzzy axiomatic design together, is proposed for the personnel selection problem.
2 - Moderating effect of relationship investment on logistics outsourcing risk

Ming-Chih Tsai, 205.Kuo Kuang Rd., Taichung 402,Taiwan,R.O.C., 402, Taichung, Taiwan, g9644009@mail.nchu.edu.tw, Wan-Ling Zhuang

This study constructs a risk model to examine logistics outsourcing based on transaction cost economics and resource based view. Risk perception of 42 Taiwanese wholesalers was collected and classified into three levels by relation investment. By using Analytical Network Process, we calibrated risk magnitude. The result indicates that opportunism was the main reasons for relational failure and ineffective asset utilization and deterioration of operation were most significant for risk impact. ANOVA concludes the importance of risk factors was insignificantly varied by relation investment level.

# TG-06
Tuesday 17:40-18:25
Koch

Delegation and Incentives
Stream: Delegation and Incentives

Invited session
Chair: Christian Hofmann, Accounting, University of Mannheim, Schloss, 68131, Mannheim, Germany, Hofmann@bwl.uni-mannheim.de
Chair: Peter Letmathe, Chair of Value Chain Management, University of Siegen, Hoelderlinstr. 3, 57076, Siegen, Peter.Letmathe@uni-siegen.de
Chair: Jan Bouwens, Tilburg University, CentER amd Department of Accountancy, PO Box 90153, 5000, Tilburg, Netherlands, j.bouwens@uvt.nl

1 - Accounting earnings, market price, and decentralized managerial compensation contracts

Christian Hofmann, Accounting, University of Mannheim, Schloss, 68131, Mannheim, Germany, Hofmann@bwl.uni-mannheim.de

This paper employs a multi-tier agency model where the shareholders delegate contracting with a manager to a board of directors to initially provide a characterization of the relative weights assigned to two performance measures in the manager’s optimal linear compensation contract. I apply this characterization to a setting in which the compensation contract is based on accounting earnings and market price. I show that delegating the design of the manager’s contract to a board of directors substantially affects the characteristics of compensation contracts based on earnings and price.

2 - The economics of full cost transfer pricing

Jan Bouwens, Tilburg University, CentER amd Department of Accountancy, PO Box 90153, 5000, Tilburg, Netherlands, j.bouwens@uvt.nl

Full cost transfer pricing has been criticized for providing production units with too few incentives to economize on costs. Our empirical study shows that charging too high a price for products has the potential to send a production unit into a death spiral. However we also find evidence that production unit managers take cost reduction measures to stay in business. They shift the fixed cost burden imposed on particular products and manage (down) variable costs in order to use the resulting transfer price changes for enhancing internal demand.

# TG-07
Tuesday 17:40-18:25
GS1 - S 29

MCDA: Portfolio Decision Analysis (Panel Discussion)
Stream: Multiple Criteria Decision Analysis

Invited session
Chair: Alec Morton, Management/ Operational Research, London School of Economics, Houghton St, London, wc2a2ae, London, England, United Kingdom, a.morton@lse.ac.uk
Chair: Ahti Salo, Systems Analysis Laboratory, Helsinki University of Technology, P.O. Box 1100, Otakaari 1 M, 02015, TTK, Finland, ahti.salo@tkk.fi
Chair: Jeff Keisler, Boston College of Management, University of Massachussets, 100 Morrisey Blvd., 02125-3393, Boston, MA, United States, j.keisler@umb.edu

1 - Panel discussion: portfolio decision analysis - bridging theory and practice

Ahti Salo, Systems Analysis Laboratory, Helsinki University of Technology, P.O. Box 1100, Otakaari 1 M, 02015, TTK, Finland, ahti.salo@tkk.fi, Alec Morton, Don Kleinmuntz, Valerie Belton, José Rui Figueira, Larry Phillips, Alexis Tsoukias

An indicator of the liveliness of any area of OR is a healthy interaction between practice and theory. In an applied discipline, practice provides the ultimate motivation for theoretic questions, but an excessive reverence for practice can block learning and hinder interdisciplinary innovation. Theory underpins the development of methods and tools, but theoretic inquiry can lose sight of application and become an end in itself. As an emerging subfield of Decision Analysis, has Portfolio Decision Analysis got the balance right, and, if not, what should we do about it?

# TG-08
Tuesday 17:40-18:25
GS1 - S 30

Procurement and Pricing
Stream: Supply Chain Management

Invited session
Chair: Christian Lohmann, Ludwig-Maximilians-Universität München, Institut für Produktionswirtschaft und Controlling, Ludwigstraße 28 RG/V, D-80539, München, Germany, lohmann@bwl.lmu.de

1 - The utility of compensatory payments between independent companies of one value network

Christian Lohmann, Ludwig-Maximilians-Universität München, Institut für Produktionswirtschaft und Controlling, Ludwigstraße 28 RG/V, D-80539, München, Germany, lohmann@bwl.lmu.de
Inter-company dependencies determine the nature of their ability to collaborate, as well as the coordination instruments that may be applicable. This article examines a scenario under which two independent companies with pre-existing sales interdependencies may elect to form a value network. Revenue-based and quantity-based compensatory payments are analyzed and compared in terms of the extent to which they result in efficient investment and production decisions. We thereby identify conditions under which the selected compensatory payments can increase the expected profits of both companies.

**TG-09**

**Tuesday 17:40-18:25**

**GSI - S 5**

**Task/Event Timetabling**

**Stream:** Timetabling and Rostering  
**Invited session**

Chair: O.t. Arogundade, Computer Science, University Of Agriculture, 2240, Abeokuta, Nigeria, arogundadeo@acm.org

1 - Insight from visualisation and the travelling tournament problem  
Mark Johnston, School of Mathematics, Statistics and Operations Research, Victoria University of Wellington, PO Box 600, 6140, Wellington, New Zealand, mark.johnston@msor.vuw.ac.nz

The Travelling Tournament Problem (TTP) involves constructing a double round robin sports tournament to minimize the total distance travelled by teams, with side constraints. Although the TTP is extremely difficult to solve, metaheuristics expect to find good solutions. Computational experiments are presented to validate the quality of the solutions found. The obtained results allow to understand the geometric structure of good solutions.

2 - On demand conference planning  
Eric Bourreau, COCONUT, LIRMM, 161 Rue Ada, 34000, Montpellier, France, eric.bourreau@lirmm.fr

ECAP (European conference on Computing And Philosophy) planning is a hard problem due to 2 major specificities: 1/It is not easy to restrict new philosophic theory with only few available keywords and allocate each talk in predefined session streams. 2/During the month before the conference, accepted papers are available on a wiki debate platform and open to discussion. As usual in conference, parallel sessions bring conflicting presentations, but due to debates, we are able to estimate interests for the expected participants. We propose to deliver an "On Demand Conference Planning".

**TG-11**

**Tuesday 17:40-18:25**

**GSI - S 17**

**Clustering Techniques for MCDA**

**Stream:** Multiple Criteria Decision Analysis  
**Invited session**

Chair: Yves De Smet, SMG - CODE, Université Libre de Bruxelles, Boulevard du Triomphe CP 210-01, 1050, Bruxelles, Belgium, yves.de.smet@ulb.ac.be

1 - Multicriteria ordered clustering  
Yves De Smet, SMG - CODE, Université Libre de Bruxelles, Boulevard du Triomphe CP 210-01, 1050, Bruxelles, Belgium, yves.de.smet@ulb.ac.be, Philippe Nemery, Ramkumar Selvaraj

We propose a new approach for the detection of ordered clusters in multicriteria decision aid problems. This is referred to as the multicriteria ordered clustering problem. At first, preference degrees between pairs of alternatives are computed. Based on the definition of two indicators characterizing the quality of partitions, an optimization problem is formalized and an exact algorithm is proposed. Our approach is tested on artificial data sets and illustrated on a pedagogical example.

2 - Relational multicriteria clustering: the case of valued outranking matrices  
Stefan Eppe, Engineering Faculty, CoDE-SMG., Université Libre de Bruxelles, Boulevard du Triomphe CP 210-01, 1050, Brussels, Belgium, stefan.eppe@ulb.ac.be, Julien Roland, Yves De Smet

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1 - Toward a satisfaction barometer of mobile telephony in Greece.  
Dimitrios Drosos, Department of Business Administration, Graduate Technological Education Institute of Piraeus, 250, Thivon ave., 12244, Aigaleo, Greece, drososd@in.teipir.gr, Yannis Siskos, Nikos Tsotsolos, Antonis Zervos

A satisfaction barometer is a significant tool for an organisation because of emphasis on meeting the expectations and needs of customers. This paper presents an original study that measures the customer satisfaction of mobile telephony services in Greece. For the analysis of the survey results the multicriteria methodology MUSA (Multicriteria Satisfaction Analysis) was applied. The most important results are focused on the determination of the weak and the strong points of the mobile telephony companies and the analysis of customers’ behavior.

2 - Measuring the robustness of multicriteria decision models in uta-type disaggregation procedures.  
Yannis Siskos, Department of Informatics, University of Piraeus, Karaoli Dimitriou 80, 18534, Piraeus, Greece, ysiskos@unipi.gr

A major problem that any disaggregation procedure in MCDA has to face is the robustness of preference models inferred mainly through linear programming mechanisms. This paper measures the robustness of additive value models inferred from UTA-type procedures by means of LP's post optimality analysis in which the main proposed measure is the average stability index (ASI). The paper is illustrated by numerical examples where several proposed rules increase the model robustness.
This presentation addresses the question of relational multicriteria clustering. Our previously developed approach for handling binary outranking matrices will be extended to the case of valued outranking relations. After discussing the implications and consequences of this widening, the k-means algorithm will be applied on it. Validation results of tests performed on artificial data sets will be presented. Special emphasis will be put on comparing the results obtained with the valued and the binary version of the algorithm.

**TG-12**

**Tuesday 17:40-18:25**  
**GSI - S 18**  
**Location and routing**  
**Stream: Location Analysis**  
**Invited session**  
Chair: Carlos Ferreira, Dep. of Economics, Management and Industrial Engineering, University of Aveiro, Campus Universitário de Santiago, 3810-143, Aveiro, Portugal, carlosf@ua.pt  
Chair: Rui Borges Lopes, Dep. of Economics, Management and Industrial Engineering, University of Aveiro, Campus Universitário de Santiago, 3810-143, Aveiro, Portugal, rui.borges@ua.pt

1 - *A lower bound and upper bound for the capacitated location-routing problem*

Zhen Yang, 12, rue Marie Curie, BP2060, 10010, Troyes, zhen.yang@utt.fr, Feng Chu, Chen Haoxun

This paper studies a logistic network design problem, the capacitated location-routing problem (CLRP) NP-hard, which simultaneously considers the location of facilities and the management of vehicle fleets subjected to capacity constraints. A cutting plane method is present to obtain a lower bound (LB). Based on the LB solution, an initial feasible solution is constructed by a heuristic. A TABU search heuristic is then proposed to improve the initial feasible solution. Benchmarked on classical instance, computational results manifest that this method can obtain high quality solutions.

2 - *A capacitated location-routing problem: a heuristic approach and decision support*

Rui Borges Lopes, Dep. of Economics, Management and Industrial Engineering, University of Aveiro, Campus Universitário de Santiago, 3810-143, Aveiro, Portugal, rui.borges@ua.pt, Carlos Ferreira, Beatriz Sousa Santos

We consider a discrete Capacitated Location-Routing Problem (CLRP) with two levels (depots and clients) and a capacitated and homogeneous vehicle fleet. For this model a decision support tool is presented supporting a newly developed metaheuristic. The metaheuristic, composed of two stages, is based on guided local search (GLS) providing best average results for two out of three benchmark instances for the CLRP. The GLS is used to guide a composite local search, both embedded in a hybrid extended savings algorithm in the first stage and, on the second stage, to conduct a more thorough search.

**TG-13**

Tuesday 17:40-18:25  
**GSI - S 31**  
**Covering location models**  
**Stream: Location Analysis**  
**Invited session**  
Chair: Ioannis Giannikos, Business Administration, University of Patras, University of Patras, GR-26500, Patras, Greece, I.Giannikos@upatras.gr

1 - *Wireless local area network planning robustness*

Alexandre Gondran, SET, UTBM, Université des Technologies de Belfort, 90000, Belfort, alexandre.gondran@utbm.fr

WLAN planning consists in selecting a location for each transmitter and allocating frequency used by all sites in order to provide users a wireless access to their local network. The objective is to guarantee a given Quality of Service (QoS). Our optimization algorithm tackles location selection and frequency assignment together. In this presentation we evaluated an robust aspect of our planning. The QoS evaluation is based on given input data: users demand and power maps (received signals strength from all transmitters). We study quality of our solutions across changing those input data.

2 - *Partial coverage-based maximal demand covering models*

Ioannis Giannikos, Business Administration, University of Patras, University of Patras, GR-26500, Patras, Greece, I.Giannikos@upatras.gr, Georgios Alexandris

In this paper we concentrate on the well known Maximal Coverage Location Problem and demonstrate that alternative representations of the demand space may lead to largely fluctuating as well as misleading results. We introduce a family of models based on the notion of complementary partial coverage and exploit the capabilities of Geographic Information Systems in order to better represent demand. Results of empirical studies indicate that the proposed models are less susceptible to fluctuations for alternative representations of the demand space.

**TG-14**

Tuesday 17:40-18:25  
**GSI - S 32**  
**Inventory Management II**  
**Stream: Inventory Management**  
**Invited session**  
Chair: John J. Kanet, Operations Management - Niehaus  
Chair in Operations Management, University of Dayton, 300 College Park, 45469, Dayton, OH, United States, kanet@udayton.edu

1 - *Interpretation of classical eoq model as the object of discrete control in a spreadsheet*

Slobodan Antic, Department of operations management, Faculty of organizational sciences, Jove Ilica 154 Street, Belgrade, Serbia, 11000, Belgrade, Serbia, antics@fon.rs, Dragan Vasiljevic
The paper describes the way how basic EOQ model can be presented as object of discrete control and simulation model of inventories in a spreadsheet. Model can be developed in a spreadsheet in order to perform simulation, and table analysis. EOQ model belongs to group deterministic, continuous models, where inventory dynamics is observed for one period of time. Results of model output are the fixed amount of order quantity per year and number of orders per year. Continuous time period, we can present as the sequence of discrete time periods with discrete quantities of inventories in it.

2 - Dynamic planned safety stocks in supply networks

John J. Kanet, Operations Management - Niehaus Chair in Operations Management, University of Dayton, 300 College Park, 45469, Dayton, OH, United States, kanet@udayton.edu, Michael Gorman, Martin Stoesslein

We introduce a new line of research in inventory management: the notion of planning time phased safety stocks. We assert that planning a time phased set of safety stocks (SS) over a planning horizon makes sense because larger SS are appropriate in times of greater uncertainty while lower SS are more appropriate when demand and/or supply are more predictable. We perform an empirical study of US industry, which demonstrates that significant savings can be achieved by employing dynamic planned safety stocks. We provide a optimization model for the problem of minimizing inventory.

TG-15

Tuesday 17:40-18:25
Einstein

Multicriteria Decision Making

Stream: Multi-Objective Optimization and Decision Theory 2

Invited session

Chair: Boglarka G.-Toth, Differential Equations, Budapest University of Technology and Economics, Egry Jozsef u. 1., 1111, Budapest, Hungary, bog@math.bme.hu

1. "overview algorithms in multicriteria optimization"

Claudia Margarita Villagran de Leon, Faculty of Medicine., University San Carlos of Guatemala, 9 Avenida 9-45 Zona 11,CentroUniversitario, CUM,Colonia Roosevelt.,01011, Guatemala, Guatemala, margavilla2008@hotmail.com

Several Criteria quantitative, qualitative, dependent,independent, hard or software & all together are handled at the same time. Multi causes & effects of decision cases are examined from different DB & opposite objectives. Efficient software for (MCO),by means of (MOC),Vector and (CO). Using math formulation & procedures, we reach Optimality Criteria depending on (MCDM), simulation.

We set main objectives, algo.& opposite criteria.(MCO)paradigm is for diverse applications: design Urban city plan.airplanes,turbinas, bridges use(GIS)system. Medical Cancer examples to discuss.

2. A reliable method for obtaining the complete weakly efficient set of nonlinear biobjective optimisation problems

Boglarka G.-Toth, Differential Equations, Budapest University of Technology and Economics, Egry Jozsef u. 1., 1111, Budapest, Hungary, bog@math.bme.hu, Jose Fernandez

obtaining the complete efficient set of nonlinear multiobjective optimisation problems is a very difficult task, that some people think to be impossible to achieve. However, a recent interval branch-and-bound method has been proposed in the literature (see COAp, doi:10.1007/s10589-007-9135-8) which is able to obtain a superset containing the complete weakly efficient set of (nearly) any nonlinear biobjective optimisation problem, up to a pre-specified accuracy. In the talk we will present the method, and will discuss its applicability to general nonlinear biobjective problems.

TG-16

Tuesday 17:40-18:25
Koenig

Multicriteria Location and Routing

Stream: Multi-Objective Optimization and Decision Theory 1

Invited session

Chair: Utpal Bhattacharya, OM&QT Area, Indian Institute of Management Indore, IIM Indore, 453331, Indore, India, 453331, Indore, MP, India, utpalb@iimidr.ac.in

1. Multicriteria capacitated redistricting problem

Paulo Morelato França, Dept. Matemática, Estatística e Computação, Universidade Estadual Paulista, Av. 11 de maio 2137, apto. 172 B, 19061-360, Presidente Prudente, SP, Brazil, paulo.morelato@gmail.com, Laura Assis, Fábio Usberti, Vinicius Garcia

The capacitated version of a redistricting problem with three objectives is addressed. The solution approach divides the problem into two hierarchical phases. First, a given original districting solution is optimized with respect to the two initial criteria, treated as a weighted single criterion and solved by a GRASP method. Afterwards the third objective, which corresponds to seek for the minimum deviation between the solution found in the first step and the original one is optimized by a heuristic and also by an exact method. Computational experiments are provided.

2. A multi-objective vertex covering obnoxious facility location problem on a plane

Utpal Bhattacharya, OM&QT Area, Indian Institute of Management Indore, IIM Indore, 453331, Indore, India, 453331, Indore, MP, India, utpalb@iimidr.ac.in

In this article a new Vertex Covering Obnoxious Facility Location problem on a Plane has been designed by considering it as a MCDM problem. The problem has been dealt as a pure planar location problem. A modified linear programming algorithm based on Drezner and Wesolowsky [1983] has been designed. The basic difference in this model than the existing obnoxious facility location models is that the weights or importance are assigned to the various demand points instead of assigning to the various distances.
Two-sided assembly lines are generally occurred in assembly of large-sized products such as buses and trucks. In a two-sided assembly line, different assembly tasks are carried out on the same product in parallel at both left and right sides of the line. In this study Bees Algorithm is adopted to solve two-sided assembly line balancing problem with zoning constraints so as to minimize the number of stations for a given cycle time. The efficiency and robustness of the proposed algorithm is tested on benchmark problems existing in the literature.

**TG-20**

**Tuesday 17:40-18:25**

Mann

**AHP VII**


*Invited session*

Chair: Alessio Ishizaka, Portsmouth Business School, University of Portsmouth, Richmond Building, Portland Street, PO1 3DE, Portsmouth, Hampshire, alessio.ishizaka@port.ac.uk

1 - Does AHP help us make a choice? - an experimental evaluation

Alessio Ishizaka, Portsmouth Business School, University of Portsmouth, Richmond Building, Portland Street, PO1 3DE, Portsmouth, Hampshire, alessio.ishizaka@port.ac.uk

We use experimental economic methods to test how well AHP fares as a choice support system in a real decision problem involving a dominant criterion. The AHP ranking is statistically compared with three successive rankings given by the subjects in the experiments themselves (one at the beginning, one after using AHP and one after learning the ranking provided by AHP). We observe all four rankings are similar but the rankings provided by the subjects are closer to each other than the AHP ranking. However, AHP rankings help the decision-maker to reformulate his choice.
1 - Combined dematel technique with a novel MCDM model for bridges improvement

Gwo-Hshiung Tzeng, College of Management, Hsinchu 300, National Chiao Tung University, Kainan University, Taoyuan 338, Taiwan, ghtzeng@cc.nctu.edu.tw, Yi-Chun Chen

Local scour of channels usually affect and destroy the structures’ foundations of bridges. Therefore, prioritizing which bridges to be enhanced is the most critical issue. An ANP based hybrid MCDM framework is proposed and verified by an empirical case study.

2 - Fuzzy MCDM approach for selecting the best environment-watershed plan

Yi-Chun Chen, Graduate Institute of Civil and Hydraulic Engineering, Feng Chia University, No. 100 Wenhu Rd., Seatwen, 40724, Taichung, Taiwan, chen.vivien@gmail.com, Gwo-Hshiung Tzeng

The most criteria in the real world decision problems are vague, interdependent and interactive which cannot be evaluated by conventional measures method. Thus, this paper intends to propose a fuzzy multi-criteria decision making (FMCDM) framework to select the best alternatives/strategies in environment-watershed. This framework will be verified by a real-world environment-watershed plan.

3 - Evaluation and enhancement of the best environment watershed plan using a novel hybrid MCDM model

Yi-Chun Chen, Graduate Institute of Civil and Hydraulic Engineering, Feng Chia University, No. 100 Wenhu Rd., Seatwen, 40724, Taichung, Taiwan, chen.vivien@gmail.com, Gwo-Hshiung Tzeng

An environment watershed plan is usually affected by various factors including human life, property, nature ecology, etc. However, how to prioritize the factors for further plan improvement is critical and seldom be addressed. Thus, the authors proposed an ANP based hybrid MCDM model for defining strategies to close the gaps between the current states as well as the aspired levels of the factors. A real world case study is used to demonstrate the proposed model.

In this paper we examine the environmental, social and economical sustainability of a closed-loop supply chain with recycling activities. We develop a dynamic model using System Dynamics methodology. The developed model is implemented to a real world electrical and electronic equipment recovery system in Greece. We present its current status and the barriers constraining its sustainability. Numerical analysis examines alternative actions to achieve a sustainable future from an environmental, social and economical approach.

TG-23

Tuesday 17:40-18:25
Planck

Portfolio Management

Stream: Financial Modelling

Invited session

Chair: David Wozabal, ISDS, University of Vienna, Bruenner Str. 72, A-1210, Vienna, Austria, david.wozabal@univie.ac.at

1 - Using black & litterman framework for stress testing analysis in asset management

Rosella Giacometti, Mathematics and Statistics, University of Bergamo, via dei Ciancian 2, 24127, Bergamo, Italy, rosetta.giacometti@unibg.it, Domenico Mignacca

In this paper, starting from the Black and Litterman model, we propose a stress test methodology of the current managed portfolio. More precisely we shock the model with shocks of factors which affect the returns, imposing the analysts’ views on their variation form the current level. We assume that a mixture of normal distributions can describe the presence of high volatility periods and low volatility periods, taking in account extreme movements in the market. We then derive the conditional moments of the posterior distribution combining views on the factors and market information.

TG-24

Tuesday 17:40-18:25
GSI - S 20

Abnormal Extrema in Nonlinear Problems

Stream: Nonlinear Programming

Invited session

Chair: Tatiana Tchemisova, Departmento of Mathematics, University of Aveiro, Campus Universitario de Santiago, 3810-193, Aveiro, Portugal, tatiana@ua.pt

Chair: Aram Arutyunov, the Department of Nonlinear Analysis, Peoples Friendship University of Russia, Lomonosovski prospect, 18, apt 396, 119290, Moscow, Russian Federation, arutun@orc.ru

1 - Second-order necessary optimality conditions for abnormal problems with equality and inequality constraints

Aram Arutyunov, the Department of Nonlinear Analysis, Peoples Friendship University of Russia, Lomonosovski prospect, 18, apt 396, 119290, Moscow, Russian Federation, arutun@orc.ru, Dmitry Karamzin, Fernando Pereira

This talk concerns second-order necessary conditions for an abnormal local minimizer of nonlinear optimization problem with equality and inequality constraints. The obtained optimality conditions improve the ones available in the literature in that the associated set of Lagrange multipliers is the smallest possible.
2 - Optimality conditions in discrete optimal control problems: the abnormal case
Bohan Marinkovic. Applied Mathematics, Faculty of Mining and Geology, Dzusina 7, 11000, Belgrad, mbohan@verat.net, Aram Arutyunov

We consider discrete optimal control problems with equality control constraints and mixed initial and final state equality constraints. We derive first-order optimality conditions which are meaningful under the new nontriviality condition. Note that by nontriviality we mean Lagrange multiplier which corresponds to the cost functional is nonzero.

TG-25
Tuesday 17:40-18:25
GSI - S 25
Industrial Organization
Stream: Dynamical Systems and Game Theory
Invited session
Chair: Fernanda A. Ferreira, Mathematics, ESEIG - Instituto Politécnico do Porto, R. D. Sancho I, 981, 4480-876, Vila do Conde, Portugal, fernandaamelia@eu.ipp.pt

1 - Duopoly model with technology transfer
Fernanda A. Ferreira, Mathematics, ESEIG - Instituto Politécnico do Porto, R. D. Sancho I, 981, 4480-876, Vila do Conde, Portugal, fernandaamelia@eu.ipp.pt

We study the optimal patent licensing under Cournot duopoly where the technology transfer takes place from an innovative firm, which is relatively cost-efficient in the pre-innovation stage compared to the recipient firm. We determine the output levels at the Nash equilibrium and the corresponding profits of the firms. We found that the optimal licensing arrangement often involves a two part tariff, fixed fee plus a linear per unit output royalty.

2 - Dumping in an international trade
Flávio Ferreira. Mathematics, ESEIG - Instituto Politécnico do Porto, R. D. Sancho I, 981, 4480-876, Vila do Conde, Portugal, flavioferreira@eu.ipp.pt, Nilanjan Banik, Fernanda A. Ferreira, Alberto A. Pinto

The literature of international trade mentions the following way in which the domestic firm can make its government impose a tariff: the domestic firm strategically alters its behavior (trying to make the foreign firm deviate) and thereby influence antidumping outcome in the second stage of the game. In this paper, we consider different firms’ behaviors and we will study when there are, or not, advantages to deviate.

TG-26
Tuesday 17:40-18:25
GSI - S 35
Packing problems
Stream: Discrete Optimization
Contributed session
Chair: Vladimir Kotov, Discrete Math. and Algorithmica, Belarus State University, Independence avenue 4, 220030, Minsk, Belarus, kotovvm@yandex.ru

1 - Polynomial optimal algorithm for solving subset vector problem in the space with fixed dimension.
Ivan Rykov, Theoretical cybernetics, Sobolev Institute of Mathematics, 4 Acad. Koptyug avenue, 630090, Novosibirsk, Russian Federation, rykov@ngs.ru, Edward Gimadi, Artem Pyatkin

We consider the following problem: given a finite set \( V = \{v_1, v_2, ..., v_n\} \) in Euclidean space \( \mathbb{R}^k \) and a natural number \( m < n \). Find a subset of \( m \) vectors from \( V \) with maximal norm of sum. This problem is NP-hard [1]. We provide an optimal combinatorial algorithm with the time complexity \( O(k^2n^2k) \). So the problem is polynomially solved for each fixed dimension \( k \). Baburin, Gimadi, Glebov, Pyatkin. The problem of finding a subset of vectors with the maximum total weight. // J. Appl. Industr. Math, 2008. V2, N1. The work is supported by RFBR (projects 08-01-00516, 07-07-00222).

2 - Approximation algorithms for the \( k_i \) partitioning problem
Vladimir Kotov, Discrete Math. and Algorithmica, Belarus State University, Independence avenue 4, 220030, Minsk, Belarus, kotovvm@yandex.ru, Hans Kellerer

We consider the problem of assigning \( n \) independent items to \( m \) parallel machine, each having an associated machine dependent cardinality limit, such that the maximum completion time is minimized and the number of items on each machine does not exceed the corresponding cardinality limit. We present approximations algorithm for this problem in case of identical and a uniform machines.

TG-27
Tuesday 17:40-18:25
GSI - S 21
Routing Problems
Stream: Discrete Optimization
Contributed session
Chair: Aydin Sipahioglu, Industrial Engineering, Osmangazi University, Meselik, 26480, Eskisehir, Turkey, asipahi@ogu.edu.tr

1 - Branch-and-price for a split pickup and split delivery problem
Frank Henri, Department of Industrial Economics and Technology Management, Norwegian University of Science and Technology, Alfred getz veg 3, NO-7491, Trondheim, Norway, frank.hennig@iot.ntnu.no, Marco Lubbecke, Bjorn Nygreen

In industrial shipping a problem arises in which multiple products are shipped between several origins and destinations. Product quantities are given in pickup and delivery time windows. In case of multiple time windows for a product no origin-destination pairs are specified. Pickup and delivery quantities can be split among heterogeneous ships. Restrictions lead to arc dependent ship capacity constraints. We present results for a column generation approach. The pricing problem is solved by branch-and-price itself and has to find optimal routes, schedules and cargo amounts for each ship.

2 - A new heuristic for multi-depot & heterogeneous fleet capacitated arc routing problem
Aydin Sipahioglu, Industrial Engineering, Osmangazi University, Meselik, 26480, Eskisehir, Turkey, asipahi@ogu.edu.tr, Gokhan Kirlik
It is known that one of the most successful heuristic algorithms for solving Capacitated Arc Routing Problem (CARP) is Ulusoy’s algorithm which was proposed in 1985. However, Ulusoy’s algorithm doesn’t consider multi-depot case, although it considers heterogeneous fleet case by using branch and bound type procedure. In this study, a new approach, which allows multi depot and heterogeneous fleet cases together, is proposed by developing Ulusoy’s algorithm. The approach consist a mathematical model to solve shortest path problem which is different from classical shortest path problem.

1 - A scenario based approach to analyze innovation performance of countries

Gündüz Ulusoy, Industrial Engineering, Sabanci University, Orhanli, Tuzla, 34956, Istanbul, Turkey, gunduz@sabanciuniv.edu, Fussun Ulengin, Emel Aktas, Sule Onsel, Özgür Kabak

This study proposes a scenario based approach to analyze innovation performance of countries. Initially a workshop is gathered to revise the indicators used in European Innovation Scoreboard and to reveal dependencies among them. Related indicators can be classified into 5 dimensions: innovation drivers, knowledge creation, innovation & entrepreneurship, applications, and intellectual property. Then, a Bayesian Belief Net is developed to create and analyze different scenarios for the transition of countries between 4 categories such as leaders, followers, moderates, and catching-up countries.

2 - Generating artificial macroeconomic frameworks: an expert-driven approach based on artificial intelligence

Esther Arenas-Arroyo, Economy, ETEA, Business Administration Faculty, University of Cordoba, Spain, Escritor Castillo Aguayo 4, 14004, Cordoba, Cordoba, Spain, esara85@hotmail.com, Carlos Ramón García Alonso, Gabriel M. Pérez-Alcalá

Based on System Analysis, an artificial macroeconomic model has been designed and studied overtime using Monte-Carlo Simulation, Fuzzy Inference and Bayesian statistics. Not only economical variables but also demographic, technological, political and legal variables as well as their dependence relationships are taken into account. This model allows us to analyze artificial macroeconomic environments when some variables are modified. When a dependence relationship is fuzzy a new way for representing massive fuzzy relationships is introduced and checked with or without a priori information.

TG-28

Channel Coordination

Stream: Demand and Supply in Consumer Goods and Retailing

Invited session

Chair: Alexander Hübner, WFI - chair of production management Prof. Dr. Kuhn, Catholic University Eichstätt-Ingolstadt, Auf der Schanz 49, 85049, Ingolstadt, alexander_huebner@mckinsey.com

1 - Optimal bundling for single-period inventory problem

Gregory Gurevich, Industrial Engineering and Management, Sami Shamoon College of Engineering, Byalik str., 84100, Beer Sheva, Israel, gregoryg@sce.ac.il, Baruch Keren, Yuval Cohen, Yossi Hadad

Discount bundles are common strategy of producers, wholesaler and retailers. The paper explores the producer/wholesaler profit maximizing bundle content (the ratio among the products in the bundle) and the bundle price. A general analytic solution for two items is described. Numerical examples demonstrate the solution for special cases of uniform distribution and the importance of bundle optimization (content and price). The analysis reveals that bundling can be a coordination tool which may increase the expected profit for both parties: producer and retailer alike.

2 - Optimal order and production policies in a vmi

Deniz Kubali, GSSE Industrial Engineering, Koc University, Rumelifeneri Yolu, Saryer, 34450, istanbul, denizkubali@gmail.com, Omur Kaya, E. Lerzan Ormeci

Our study focuses on the coordination of order and production policies between a supplier and a retailer when the production and demand rates of a specific product are known and constant. We consider a vendor-managed inventory system, where supplier determines the length of the inventory replenishment cycle and the order quantity of the retailer. We prove that the optimal shipment dispatch policy is non-stationary and we derive algorithms for both capacitated and infinite cargo capacity. Their performances are discussed through a numerical study.

TG-29

Computational Economics 1

Stream: Financial Modelling

Invited session

Chair: Ronald Hochreiter, Statistics and Decision Support Systems, University of Vienna, Universitaetsstrasse 5, 1010, Vienna, Austria, ronald.hochreiter@univie.ac.at

1 - Network optimization for decisions under uncertainty conditions

Massimo Di Francesco, Department of Land Engineering, UNIVERSITY OF CAGLIARI, Piazza d’armi, 09123, Cagliari, Sardinia, Italy, massimo@unic.it, Teodor Gabriel Crainic, Paola Zuddas

We present a time-extended multi-scenario approach to address network optimization for decisions under uncertainty conditions and data shortage. This formulation can exploit the subjective knowledge of decision makers to generate a set of scenarios and determine decisions, when historical data are inadequate. We investigate its effectiveness in terms of total operating costs and demand fulfillment by a validation testing phase in synthetic instances and real word applications. First results show that this approach allows improving demands fulfillment minimizing consequences of scarce resources.
2 - An interior-point algorithm for mixed complementarity problems

Sandro Mazorche, Matematica, Universidade Federal de Juiz de Fora, Campus Universitario - Bairro Martelos, 36036-900, Juiz de Fora, MG, Brazil, sandro.mazorche@ufjf.edu.br, Jose Herskovićs

Complementarity problems arise in mathematical models of several applications in Engineering, Economy and different branches of Physics. We mention contact problems and dynamic of multiphase systems in Solid Mechanics. In this paper we present a new feasible directions interior-point algorithm for mixed nonlinear complementarity problems that we have called FDA-MNCP. Results about global and asymptotic convergence for the FDA-MNCP algorithm are stated. Numerical results obtained with the proposed algorithm for several well known benchmark problems are presented.

TG-31

Large Scale Feature Selection and Classification

Stream: Optimization and Data Mining

Invited session

Chair: Giovanni Felici, Istituto di Analisi dei Sistemi ed Informatica, Consiglio Nazionale delle Ricerche, Viale Manzoni 30, 00185, Roma, Italy, felici@iasi.cnr.it

1 - Support vector machine and integer programming for time series prediction

Renato De Leone, Dipartimento di Matematica e Informatica, Università di Camerino, via Madonna delle Carceri 9, 62032, Camerino, MC, Italy, renato.deleone@unicam.it, Emilia Marchitto, Risi Arnaldo, Riccardo Bilancioni

In this talk we will present a novel approach based on Support Vector Machines and Integer Programming formulation for feature selection and multivariate time series prediction. Given a multivariate time series, and some aggregate information on these data, the objective is to determine future aggregate values using a subset of the components of the multivariate time series. This will be achieved using an Integer Linear Programming approach and Support Vector Machines. An application to prediction of aggregated sales in high-fashion industry will be presented.

TG-32

Data mining in production

Stream: Data Mining

Contributed session

Chair: Yulia Rudinskaya, Lessingstr. 45, 09599, Freiberg, yulia.rudinskaya@bwl.tu-freiberg.de

1 - Usage of business intelligence for the optimisation of the steel research process

Yulia Rudinskaya, Lessingstr. 45, 09599, Freiberg, yulia.rudinskaya@bwl.tu-freiberg.de, Carsten Felden

The project is being conducted in cooperation with the institute of molding of the (Technical University) Freiberg, Germany. Since the experiments are very costly, due to high energy consumption and the environmental effects, the research aim is to develop a human-independent solution that allows a reduction of the number of experiments or at least its length. This could be achieved by using analytical methods known from Business Intelligence that support the reuse of knowledge gathered within former experiments.

TG-33

Tuesday 17:40-18:25

GSI - S 7

Case Studies

Stream: Linear Optimization

Contributed session

Chair: Suliadi Firdaus Safahani, Applied Mathematics, University Of Sheffield, Hicks Building, Hounsfield Road, S3 7RH, Sheffield, United Kingdom, app08sf@sheffield.ac.uk

1 - A diet planning model for Malaysian schools using linear programming

Suliadi Firdaus Safahani, Applied Mathematics, University Of Sheffield, Hicks Building, Hounsfield Road, S3 7RH, Sheffield, United Kingdom, app08sf@sheffield.ac.uk

This study aims to develop a mathematical model for diet planning that meets the required nutrient intake for the secondary school student for a two week period, as well as minimizing the catering budget per a day. Diet planning is an optimization problem in which the set of feasible solutions subject to constraints, and the goal is to find the best possible optimal solution. The problem is quite large and integer programming will be used. An automatic decision support system will be developed by using the LPSolve or similar programming language.

2 - A multicriteria model for the design and arrangement of vehicle’s maintenance and repair centers: the case of Athens municipality

Athanasios Spyridakos, Mathematics, Graduate Technological Institute of Piraeus, P. Ralli &Thivon 250, Aigaleo, 12244, Athens, Greece, tspyr@teipir.gr, Panagiotis Kyriazopoulos, Lazaros Vryzidis, Maria Litsardaki, Maria Litsardaki

The plan and the arrangement of subunits in metropolitan repair and maintenance centers for vehicles is a complicated procedure while conflicting characteristics are involved. In this research work a multicriteria model based on UTA(*) method and MINORA is presented for the arrangement of specialised units in different locations, aiming to their effective operation and the rational exploitation of the available means. For the evaluation of alternative arrangements, UTA* was utilised. The model is illustrated through a real world study for the Athens Metropolitan Municipality.
The principle of maximum entropy maximizes the entropy subject to the constraint that the effort remains constant. The principle of least effort or the Zipf’s optimization principle minimizes the effort subject to the constraint that the entropy remains constant. In this paper, I shall investigate the relation between these two principles by using a weighted entropy frame. Thus, some equivalence between these principles are stated.

2 - A real options game: investment on the project with operational options and fixed costs

Makoto Goto, Graduate School of Finance, Accounting and Law, Waseda University, 1-4-1 Nihombashi, 103-0027, Chuo-ku, Tokyo, Japan, mako.50@aoni.waseda.jp, Ryuta Takashima, Motoh Tsujimura

In this paper, we analyze investment decision on the ‘entry-exit’ project, which can be active and suspended by paying some cost, in a duopoly setting. The model incorporates Dixit (1989) and Huisman and Kort (1999). That is, we propose a new extension of the model that captures competitive nature in the recent trend. Then we show it is optimal that the rm must start producing at the beginning of the project, and the leader is more encouraged to invest in a project, which can be active and suspended by paying some cost, in an incomplete traditional markets (interest/credit).

The principle of maximum entropy maximizes the entropy subject to the constraint that the effort remains constant. The principle of least effort or the Zipf’s optimization principle minimizes the effort subject to the constraint that the entropy remains constant. In this paper, I shall investigate the relation between these two principles by using a weighted entropy frame. Thus, some equivalence between these principles are stated.
Decision Support Systems

Stream: Decision Analysis
Contributed session
Chair: Fábio Romeu de Carvalho, Paulista University, Rua Dr Bacelar 1212, 04026-002, São Paulo, SP, Brazil, fabioromeu@unip.br

1 - Functionalities of machining optimizer system in relation to the decision support system
Elesandro Baptista, Industrial Engineering Department of Uninove University, Universidade Nove de Julho, 05001-100, São Paulo, SP, Brazil, elesandro@uninove.br, Luciana Baptist, Nivaldo Coppini

Currently, the authors see different approaches to developing optimization of machining processes. The procedures created or modified, based on the appropriateness of cutting parameters according to the binomial cost/productivity. Alongside this, the authors developed, a system called Machining System Optimizer (MOS), which was developed to assist the complicated task of optimization of machining processes. The aim of this paper is to present the features of MOS for decision support system and how it helps in the process of machining to make the most correct decision for the production line.

2 - Decision making method with paraconsistent annotated logic tools and its application in selection of investment by financial institutions
Fábio Romeu de Carvalho, Paulista University, Rua Dr Bacelar 1212, 04026-002, São Paulo, SP, Brazil, fabioromeu@unip.br, Jair Minoro Abe

New types of logics are capable of handling with contradiction and uncertainty without becoming trivial. One of them is the annotated paraconsistent evidential logic E?. A proposition of E? is of the type p(a, b), in which a and b belong to interval [0,1] and represent respectively the degrees of favorable and contrary evidence expressed by p. The set ? of all pairs (a, b) constitutes a lattice of output values. In this work we present an application of the Paraconsistent Decision Method (PDM) in selection of investments, managed by the para-analyzing algorithm based on this logic.

Strategic optimization in supply chains and risk management I

Stream: Variational Problems - Theory, Methods and Applications
Invited session
Chair: Cedric Yiu, Applied Mathematics, The Hong Kong Polytechnic University, Hunghom, -, Kowloon, macyi@polyu.edu.hk

1 - Distributed optimization for a network of cooperative agents
Yapeng Lu, Industrial and Manufacturing Systems Engineering, The University of Hong Kong, Room823, 8/F, Pokfulam Road, Hong Kong, Nil, Hong Kong, Hong Kong, steven.lu@hku.hk, Henry Lau

The paper introduces a hybrid algorithm which combines Lagrangian decomposition and artificial immune systems. First of all, we obtain the Lagrangian decomposition of the original problem by relaxing the constraints that intertwine two or more sub-problems. Then, it works through a search-propagation-and-updating scheme where each agent starts with a tentative local decision by searching its finite domain, progresses to an immunity-inspired constraint propagation process, and then updates its decision according to some rule-base that is equivalent to the gradient descent method.

2 - Immune network theory based multi-objective optimization algorithm with approximate dominance consideration
Willburn Tsang, The University of Hong Kong, Department of IMSE, Pokfulam Road, Hong Kong, 000, Hong Kong, hyklau@hkucc.hku.hk, Henry Lau

In a multi-objective optimization, it is difficult to find one single solution that is optimum for all considerations. A set of solution is identified to represent the trade-off between different considerations. Multi-objective optimization problems are difficult to solve. In this respect, this study focuses on the development of new multi-objective optimization algorithms for the effective evaluation of optimal solutions. This study develops an optimization algorithm which adopts the engineering analogue of the human immune system to new multi-objective optimization algorithm.

3 - Financial management in global supply chains
Bajis Dodin, Anderson Graduate Schoo of Management, University of California, Anderson Graduate Schoo of Management, University of California, 92521, Riverside, California, United States, bajis.dodin@ucr.edu, Abdelghani Elimam

Global supply chains (SC) have branches (rings) with multiple currencies. Fluctuations in currency exchange rates over time lead to more difficulties in managing such SC. Long cycle times may impact the value of material as well as the various costs incurred within the SC rings. In this paper, we investigate the impact of currency fluctuations on the SC, and analyze the relationship between these fluctuations and the SC cycle time and its corresponding costs. This analysis led to establishing optimal and near optimal cash management policies for all the SC rings.
The groundwater is one of the most important resources used for drinking, utility and irrigation purposes within the borders of Konya province as in other areas. The purpose of this study is to evaluate the spatial changes in the level of the groundwater by using geostatistical methods. Cross-validation and kriging methods were applied in this study to evaluate the accuracy of the variogram selected for the estimation of the level of the groundwater. The results obtained from the kriging method are fairly useful for the determination of the threatening areas in terms of the groundwater.

2 - Numerically investigated of laser passively q-switching regime
Ion Ioan Ferdinand Lancreanjan, Optoelectronics, CSA-INCAS, 220 Iuliu Maniu Boulevard, Sector 6, Bucharest, Romania 061126, 061126, Bucharest, J_I_F_L@yahoo.com, Camelia Gavrila

In this paper the technique of solid-state lasers passive optical Q-switching is numerically investigated considering the case of longitudinally and transversally uniform photon, population inversion and absorption centres densities. The coupled differential equations defining photon, population inversion and absorption centres densities are numerically solved being the basis of laser functional simulation. For validating the results, the numerical simulations are performed using the SCILAB programs.

TG-40
Tuesday 17:40-18:25
GSI - S 27
Simulation based learning of complex system management
Stream: Simulation Based Decision Support
Invited session
Chair: Mirjana Kljajic-Borstar, Laboratory for Decision Processes and Knowledge-based systems, University of Maribor, Faculty of Organizational Sciences, Kidriceva 55a, 1000, Ljubljana, Slovenia, Slovenia, mirjana.kljajic@fov.uni-mb.si
Chair: Andrej Skraba, Faculty of Organizational Sciences, University of Maribor, Kidriceva cesta 55a, 4000, Kranj, Slovenia, Slovenia, andrej.skraba@fov.uni-mb.si

1 - Developmental aspects of macro-decisions in social systems
Kazimierz Turkiewicz, Independent, 61 curry Ave, Moorooka, Qld, 4105, Brisbane, Qld, kazt3@mail2me.com.au, Dominika Turkiewicz

The current global economic crisis shows that macro-decisions are very important to stimulate effectively suitable economical activity in a society. Primarily the quality of such decisions depends on the understanding of dynamics of the natural process of society’s development. Our work presents the outline of an abstract-syntactic model of an elementary cycle of development of an autocratic system, which commonly functions in societies. This model can lead to the development of simulation models for appropriate decision support.

2 - Business simulator a tool to improve learning process
Mirjana Kljajic-Borstar, Laboratory for Decision Processes and Knowledge-based systems, University of Maribor, Faculty of Organizational Sciences, Kidriceva 55a, 1000, Ljubljana, Slovenia, Slovenia, mirjana.kljajic@fov.uni-mb.si, Andrej Skraba, Davorin Kofjač

The methodology in the decision assessment of complex systems using simulation model is described. Students took part in the experiment with the task of solving a management problem. Experimental results were analyzed and discussed in the students’ projects. After the experiment, students had to complete an opinion questionnaire. The results of Criteria Function and student’s opinion support the hypothesis that simulation model application contributes to greater understanding of the problem and greater confidence in the decision-making process.

TG-41
Tuesday 17:40-18:25
GSI - S 28
Production and Operations Management 2
Stream: Production and Operations Management
Contributed session
Chair: Smail Adjabi, Recherche Opérationnelle, Laboratory LAMOS, University of bejaia, 6000, Bejaia, Algeria, adjabi@hotmail.com

1 - Optimizing the shovel-truck operation in open-pit mine based on fuzzy lp model: cased by chogart iron ore mine
Farhad Samimi Namin, Faculty of Mining and Metallurgical Engineering, Amirkabir University of Technology, 424 Hafez Ave., -, 13875-4413, Tehran, -, Farhad_S_n@yahoo.com, Alireza Cheniani

Assignment of the proper number of trucks to a shovel, based on event time studies and shifting of trucks between loading units, when any breakdowns or delays occur, optimize the overall fleet performance. Dispatching system involves uncertainty. The most important theories addressing uncertainty are fuzzy sets theories. This paper presents method for optimizing shovel truck operations using fuzzy LP model and discusses dispatching in a fuzzy environment. The uncertainty of the activities within a shovel truck system make fuzzy model more appropriate, compared with deterministic calculations.

2 - Value of quality information of returns in product recovery management
Z. Pelin Bayindir, Department of Industrial Engineering, Middle East Technical University, Middle East Technical University, Department of Industrial Engineering, 06531, Ankara, Turkey, bayindir@ie.metu.edu.tr, Altan Atabarut

We consider a recovery system where end-of-life products are converted to a number of different recovered products. Recovery options for a return depend on its level of quality, i.e., grade. The main objective of the study is to investigate the benefits of quality grade information on the profitability of recovery business. Linear programming models for alternative testing strategies under different information schemes are built for a generic multistage recovery system in a multi-period setting. An extensive computational study is carried out to quantify the value of quality information.
Taylor rule in small open economies. In line with the generally accepted opinion about inadequacy of the function with the Taylor rule reveals dramatic differences, which is crucial. The reaction of the central bank upon this shock is also studied, namely behind different optimal control problems on networks. With a combination of the two-scale convergence and the concept of S-homogenization we can determine a homogenized optimal control problem. Many applications in science and engineering lead to differential equations on very large networks with a periodic microstructure. As these problems are hard to solve we replace the local model by a system dynamics model for the creation of a cooperative, non-competitive environment. The research for this presentation was conducted in order to suggest a new concept of entrepreneurship as a collective awareness and exercise of civil rights and duties guided by collective and individual initiative as opposed to the traditional concept. In order to materialize this innovative image, the term ‘entrepreneur’ had to be linked to the ability of the students to develop the cooperation among individuals and the attainment of common goals, an attitude for which we coined the term ‘associability’.

2 - Clostridium difficile: system dynamics modelling of hospital infection outbreaks

David Lane, Interdisciplinary Institute of Management, London School of Economics and Political Science, Houghton Street, WC2A 2AE, London, United Kingdom, d.c.lane@lse.ac.uk

In 2008 the UK National Audit Office began work on Clostridium difficile infections. Staff at NAO and LSE constructed a simulation model to understand outbreaks. The stages of patient contamination, various transmission mechanisms and the cleaning of beds, toilets and staff hands are represented. The model synthesised information from a wide range of sources. It provides a formal theory of epidemic outbreaks and allows users to understand the complex consequences of the interaction of a number of transmission vectors and policy interventions aimed at combating outbreaks.

2 - Homogenization of differential equations on networks

Erik Kropat, Department of Mathematics, Friedrich-Alexander University Erlangen-Nuremberg, Martensstraße 3, 91058, Erlangen, Germany, kropat@am2.am.uni-erlangen.de

In this paper, results for nonsmooth optimal control of switching systems are reported. Application of necessary optimality condition for the switching optimal control problem is also reported, the author’s main aim is to formulate necessary optimality conditions for smooth case and extended this result nonsmooth case (switching cost functional has Frechet superdifferential and then switching cost functional has uniformly upper subdifferentiable) and extend necessary optimality for switching control problem to the exhausters.

2 - Nonsmooth switching optimal control problem

Shahlar Maharramov, math, Yasar university, Selcuk yasar camp, Univers. str, No:35-37, Bornova, 35500, Izmir, Izmir, Turkey, shahlar.maharramov@yasar.edu.tr

In this paper results for nonsmooth optimal control of switching systems are reported. Application of necessary optimality condition for the switching optimal control problem is also reported, the author’s main aim is to formulate necessary optimality conditions for smooth case and extended this result nonsmooth case (switching cost functional has Frechet superdifferential and then switching cost functional has uniformly upper subdifferentiable) and extend necessary optimality for switching control problem to the exhausters.

2 - A systems dynamics model for the creation of a cooperative, non-competitive environment

Luisa Fernanda Rodriguez Valbuena, Instituto Superior de Pedagog, Universidad Autonoma de Colombia, Cile. 175 17A-11 Casa 68 Alameda Resrvada, 1213, Bogot, D.C., Colombia, luisa_fr@yahoo.com

The research for this presentation was conducted in order to suggest a new concept of entrepreneurship as a collective awareness and exercise of civil rights and duties guided by collective and individual initiative as opposed to the traditional concept. In order to materialize this innovative image, the term ‘entrepreneur’ had to be linked up with the ability of the students to develop the cooperation among individuals and the attainment of common goals, an attitude for which we coined the term ‘associability’. The key used for this analysis was a system dynamics model.

2 - Index development for performance analysis of accreditation for engineering education

Yong Han Ju, Department of Information and Industrial Engineering Industrial Statistics Lab., 134 Shinchon-dong, Seodaemun-Gu, 120-749, Seoul, juyonghan@yonsei.ac.kr, Jin Young Choi, Jin Sook Ahn, So Young Sohn

Engineering is a critical component of modern industries and plays a core role in advancing the technical and scientific knowledge of those industries. Due to the increase in importance of engineering, additional focus such as accreditation system has been placed on engineering education. In this paper we develop performance evaluation indices for accreditation system to see if there are significant differences between graduates from accredited and non-accredited programs. Some empirical study results will be shared.
Wednesday 08:00-09:20

WA-01

Wednesday 08:00-09:20
Beethoven

Airline problems
Stream: Combinatorial Optimization

Invited session
Chair: Juan José Salazar González, Estadística e Investigación Operativa, Universidad de La Laguna (Tenerife), Av. Astrofísico Francisco Sánchez, s/n, 38271, La Laguna, Tenerife, Spain, jjsalaza@ull.es

1 - A short term approach for the collision avoidance for air traffic management problem
Francisco Javier Martin-Campo, Statistics and Operations Research, University Rey Juan Carlos, C/ Tulipán s/n Departamental II Building, Office 045., 28933, Móstoles, Madrid, Spain, javier.martin.campo@urjc.es, Alba Agustin, Celeste Pizarro Romero

We develop a pure 0-1 model based on geometric transformations for collision avoidance between any number of aircrafts in the airspace. The problem consists of deciding the optimal maneuver (velocity and altitude changes) avoiding all conflicts between aircrafts. Knowing initial coordinates, angle direction and level flight we decide the new configuration for each aircraft minimizing several objectives like velocity variation, total number of changes and returning to the original flight configuration when each aircraft is not in conflict. We suppose each aircraft goes along a straight line.

2 - On the collision avoidance for air traffic management problem. a large scale mixed 0-1 program approach
Pablo Olaso, Department of Statistics and Operations Research, Universidad Rey Juan Carlos, c Tulipán s/n, 28933, Móstoles, pablo.olaso@urjc.es, Celeste Pizarro Romero, Francisco Javier Martin-Campo

We propose a large-scale linear mixed 0-1 programming model for collision avoidance among any number of aircrafts. Only vertical manoeuvres and speed changes are allowed. Each aircraft is given a series of fixed points to traverse in its route. We then decide the flight level and speed for each aircraft at every time period, guaranteeing that collisions are avoided and trying that the aircrafts do not arrive earlier nor later than the scheduled time to their destination points, thus avoiding to spread collisions to other zones by altering the aircrafts’ scheduled routes.

3 - Cargo and passengers air transport: a hub location problem in brazil
Rafael M. A. de Figueiredo, Pontificial Catholic University of Rio de Janeiro, Industrial Engineering Department, Marques de Sao Vicente Street, 225, 950L, Gavea, 22453900, Rio de Janeiro, Brazil, rafaelmua@gmail.com, Madiagne Diallo, Nélio Pizzolato, Morton E. O’Kelly

This paper explores the expected growth rates in passenger and freight air transportation, describing the hub-and-spoke model, its main characteristics and advantages, and makes an application of a hub location model in the Brazilian market of passenger and freight, through the concept of WLU (Work Load Unit) and using the optimization software AIMMS. The model pursue to locate 3 and 4 hubs and the results for these 2 scenarios will be discussed, followed by an analysis of the main flows in the linkages made through software TRANSCAD. Key words: hub-and-spoke, location, facilities.
Robust Approaches to Airline Optimization Problems

Stream: Transportation Planning

Invited session

Chair: Ibrahim Muter, Industrial Engineering, Sabanci University, Orhanli, Tuzla, 34956, Istanbul, Turkey, imuter@su.sabanciuniv.edu

1 - Robust airline crew pairing model for managing extra flights

Ibrahim Muter, Industrial Engineering, Sabanci University, Orhanli, Tuzla, 34956, Istanbul, Turkey, imuter@su.sabanciuniv.edu, Duygu Tas, Elvin Coban, S. Ilker Birbil, Kerem Bulbul, Guvece Sahin, Dilek Tuzun Aksu, Husnu Yenigun

We discuss the management of potential extra flights that can possibly be introduced to the regular flight schedule during operation at a later point in time. We try to handle these extra flights within the regular schedule and refer to the resulting model as a robust airline crew pairing model. Before applying column generation, we discuss procedures to cover the extra flights by a given set of feasible pairings. These procedures introduce extra column-dependent constraints to the model. To handle this dynamic change in the size of the model, we propose two column generation approaches.

2 - Pricing in column generation for a robust airline crew pairing problem

Duygu Tas, Industrial Engineering and Innovation Sciences, TU/e Eindhoven University of Technology, Eindhoven, Netherlands, duygu.tas@tue.nl, Ibrahim Muter, S. Ilker Birbil, Kerem Bulbul, Guvenc Sahin, Dilek Tuzun, Husnu Yenigun

In the robust crew pairing problem (RCPP) the selected pairings cover the regular flights and the extra flights which may be introduced into the flight schedule during the operation. The crew pairing problem is usually solved by column generation methods where pricing subproblem becomes a multi-label shortest path problem (MLSP). To solve RCPP, we propose two approaches and present modifications required in MLSP. The complexity of MLSP is exponential in the number of flights. We propose one exact and two approximate rules and present our solutions through a computational study.

3 - Multi-objective strategic robust airline scheduling

Geert De Maere, School of Computer science, University of Nottingham, Jubilee Campus, 1, Wollaton road, NG81BB, Nottingham, United Kingdom, gdm@cs.nott.ac.uk, Edmund Burke, Patrick De Causmaecker

We introduce the multi-objective approaches based on re-timing and integrated re-timing and re-routing that enabled us to investigate the mutual interaction between robustness influencing characteristics in airline schedules, and their simultaneous influence on a schedule’s operational performance. Exact and approximate solution methods are introduced. Results for real world data from a major European airline are presented and discussed. The key observations are summarised and a brief overview of promising directions for future research is provided.

WA-03

Wednesday 08:00-09:20

Regan

FREIGHT TRANSPORTATION

Stream: Transportation

Invited session

Chair: Jacek Zak, Faculty of Working Machines and Transportation, Poznan University of Technology, 3 Piotrowo street, 60-965, Poznan, Poland, jacekzak@put.poznan.pl

1 - A two-level freight distribution problem: formulations and heuristic approach

Claudio Sterle, Dipartimento di Informatica e Sistemistica, Università degli Studi di Napoli, Via Claudio 21, I-80125, Napoli, Italy, claudio.sterle@unina.it, Teodoro Gabriel Crainic, Antonio Sforza

A multi-level freight distribution problem within a city logistic system is presented. It is formulated as a two-level location-routing model with capacitated facilities and capacitated routes. Three different formulations are proposed, aimed at determining the number and the locations of primary and secondary facilities, the fleet size for two different kind of trucks and the related routing on each level. A two phase tabu search heuristic working sequentially on the two levels is proposed. Results obtained on several test cases and comparison with exact solutions are presented.

2 - Mathematical and simulation based modeling of the distribution system of goods

Jacek Zak, Faculty of Working Machines and Transportation, Poznan University of Technology, 3 Piotrowo street, 60-965, Poznan, Poland, jacekzak@put.poznan.pl, Hanna Sawicka

The authors present the essence of modeling of the real distribution system of goods. This system consists of a central distribution center (dc), 12 regional dc and 11 local dc. All crucial areas have been included within the system’s analysis, such as transportation, warehousing, as well as flows of information and goods. Based on this analysis the mathematical model, including: several evaluation criteria and constraints, has been constructed. The model has been represented in the object-oriented simulation tool ExtendSim. The results of the simulation experiments have been presented.

WA-04

Wednesday 08:00-09:20

Lisz

Scheduling and Transportation

Stream: Scheduling

Invited session

Chair: Sigrid Knust, Institute of Mathematics, Technical University of Clausthal, Erzestr. 1, 38678, Clausthal-Zellerfeld, Germany, sigrid@informatik.uni-osnabrueck.de

1 - Integrated production and distribution scheduling

Christian Viergutz, Institute of Computer Science, University of Osnabrück, Albrechtstraße 28, 49076, Osnabrück, Germany, christian.viergutz@uos.de
We will discuss a model for integrated production and distribution scheduling for a perishable product, a limited-production-rate facility and non-negligible traveling times for transportation. Initially, a fixed customer sequence with time windows is considered. After that, extensions of this model will be offered such as allowing arbitrary customer sequences or multi-vehicle scenarios with the aim of incorporating more realistic restrictions from practice. We will present heuristics to solve this problem and illustrate that the combined scheduling is beneficial for the considered models.

2 - Optimization of train planning at intermodal terminals

Florian Bruns, Department of Mathematics/Computer Science, University of Osnabrück, Hunteburger Weg 56, 49088, Osnabrück, Germany, fbruns@uos.de

Train planning is the scheduling of the load plan for a train at an intermodal terminal. The train plan assigns load units like containers to rail cars. The aim of train planning is to maximize utilization of the train and minimize the cost of the terminal. The train plan accounts for various constraints. Most of these constraints model the restrictions of loading a rail car. This includes weight restrictions for the rail cars. The problem is defined as an ILP and also solved with a local search, a heuristic and a decomposition approach.

3 - Robotic cycles in cyclic flow-shop and job-shop problems without buffers and one transport robot

Sven Großemeyer, Automated Scheduling, Optimisation & Planning (ASAP), The University of Nottingham, School of Computer Science, Wallaton Road, NG8 1BB, Nottingham, Nottinghamshire, United Kingdom, svg@cs.nott.ac.uk, Peter Brucker, Edmund Burke

For large scale production the study of cyclic scheduling problems can be beneficial. In assembly lines the material handling is usually done automatically by transport robots. In the literature most authors assume that a fixed robotic cycle is given in advance. Therefore, we analyse the probabilities of feasible robotic cycles and give an overview of how to develop local search methods to determine good quality solutions for these problems.

4 - Online scheduling a fleet of transportation robots

Jens Poppenborg, University of Osnabrück, 49069, Osnabrück, Germany, jpoppenb@uos.de

A fleet of transportation robots is scheduled by modeling the problem as a hybrid job shop with transportation. Jobs only become available for scheduling at their respective release dates, i.e. schedules have to be extended and modified by an online scheduling algorithm as new jobs become available. The objective function consists of the total weighted tardiness as primary objective and the total distance as secondary objective. Results for problem instances are included.

WA-05 Wednesday 08:00-09:20
Haydn

Scheduling Applications 1

Stream: Scheduling

Invited session

Chair: Adam Wojciechowski, Mathematical Sciences, Chalmers University of Technology and University of Gothenburg, Chalmers University of Technology, 412 96, Göteborg, Sweden, wojadam@chalmers.se

1 - Modelling target volume flows in harvest scheduling subject to maximum area

Maria da Conceição Fonseca, Departamento de Estatística e Investigação Operacional, Universidade de Lisboa, Faculdade de Ciências and Centro de Investigação Operacional, Bloco C/0 Campo Grande, Cidade Universitária, 1749-016, Lisboa, Portugal, mdfonseca@fc.ul.pt, Miguel Constantino, Isabel Martins, Jorge Cadima, Mujing Ye

In Integer Programming models for harvest scheduling with restrictions on the clearcut areas (ARM), volume constraints are used to meet a non-declining flow of timber harvested over the planning horizon. In general they increase the difficulty of solving the ARM problems and do not always guarantee an acceptable deviation of the harvested volume from the first to the last periods. We propose two model approaches, in integer and multi-objective programming, to overcome these obstacles. We report a comparative study.

2 - A branch-and-price algorithm for harvest scheduling subject to maximum area restrictions

Isabel Martins, Departmento de Matemática, Instituto Superior de Agronomia, Centro de Investigação Operacional, Tapada da Ajuda, 1349-017, Lisbon, Portugal, isabelinha@isa.ul.pt, Filipe Alvelos, Miguel Constantino

We consider forest management problems with constraints on the clearcut size, using the most recent approach, the so-called area restriction model. Three main basic integer programming models for these problems have been discussed in the literature. Solving those formulations via branch-and-bound is well suited for real problems of small to medium size but not for larger problems. We describe a branch-and-price approach for that model whose number of variables is exponential. This technique was tested with both real and hypothetical forests ranging from 45 to 10901 stands.

3 - Scheduling of market processes in energy balancing market

Kamil Smolira, Institute of Control & Computation Engineering, Warsaw University of Technology, ul. Nowowiejska 15/19, 00-665, Warszawa, Poland, ksmolira@ia.pw.edu.pl, Mariusz Kaleta, Eugeniusz Toczyłowski

The time structure of market processes has big influence on the whole system efficiency, especially in case of complex markets, like an electric power market. Because market processes’ scheduling is very complicated task, we propose an approach to this problem, which consists of many multiply time repeated phases. Main of them are: sub-problem specification, definition of requirements and evaluation criteria, generation schedules propositions, simulation of obtained schedules. For each of these phases we present detailed mechanisms, which may be used during power market processes scheduling.

4 - Optimal maintenance scheduling of multicomponent systems with stochastic life limits

Adam Wojciechowski, Mathematical Sciences, Chalmers University of Technology and University of Gothenburg, Chalmers University of Technology, 412 96, Göteborg, Sweden, wojadam@chalmers.se, Michael Patriksson, Ann-Brith Strömberg
For many companies maintenance is viewed as a large source of cost, while it should rather be viewed as an investment in availability. Previously, little optimization has been performed on maintenance planning problems over a finite horizon. We focus on optimization of maintenance activities in multicomponent systems where each maintenance occasion generates a fixed cost. An integer linear programming model for opportunistic maintenance planning taking into account the uncertainty of component lives is presented, along with complexity and polyhedral analyses and preliminary numerical results.

Cluster-Optimization

Stream: Clustering

Invited session

Chair: Aysegul Ozturk, Koc University, Rumeli Feneri Yolu, Sariyer, 34450, Istanbul, Turkey, agozturk@ku.edu.tr

1 - Constrained minimum-k-star clustering and its application to the consolidation of farmland

Steffen Borgwardt, Fakultät für Mathematik, Technische Universität München, Boltzmannstr. 3, 85747, Garching, borgwardt@ma.tum.de, Andreas Brieden, Peter Gritzmann

We introduce and study a new clustering model for the consolidation of farmland based on a combinatorial reassignment of the lots in an agricultural region. While the general problem turns out to be NP-hard even in quite restricted cases, the Size-restricted Minimum-k-Star Group Partition problem is solvable in polynomial time. Based on this tractability result, we derive a general approximation algorithm which, as the mathematical analysis and economic evaluation shows, performs well in theory and practice.

2 - On the relationship between constrained clustering and Voronoi diagrams

Andreas Brieden, Universität der Bundeswehr München, Werner-Heisenberg-Weg 39, 85579, Neubiberg, Germany, andreas.brieden@uniwb.de, Peter Gritzmann

Starting with the problem of optimally clustering points in space into clusters with prescribed sizes we end up with new insight into the geometry of classical Voronoi diagrams. In particular the latter can be viewed as trivial solutions of a subclass of a family of optimization problems. The nontrivial cases lead straightforward to a generalization of the classical Voronoi diagrams.

3 - A multiobjective support vector machine based on the one-against-all method maximizing geometric margins for multiclass classification

Keiji Tatsumi, Division of Electrical, Electronic and Information Engineering, Osaka University, Yamada-Oka 2-1, 565-0871, Suita, Osaka, Japan, tatsumi@eei.eng.osaka-u.ac.jp, Tetsuzo Tanino

In this paper, we focus on the one-against-all support vector machine (SVM) for multiclass classification. The method trains binary SVMs which discriminant each class from other classes, and combine them to construct a discriminant function. However, it does not maximize the geometric margins, which can guarantee the generalization ability. Thus, we propose a multiobjective SVM model maximizing the margins. Moreover, we derive a single-objective second order cone programming problem to solve the proposed model, and verify the ability of the proposed model through numerical experiments.

4 - Classification of imbalanced datasets with 1-norm SVMs

Aysegul Ozturk, Koc University, Rumeli Feneri Yolu, Sariyer, 34450, Istanbul, Turkey, agozturk@ku.edu.tr, Serpil Sayin

Classification of imbalanced datasets in which negative instances outnumber positive instances is a common situation in real life problems. The objective of this study is to improve the performance of SVMs for imbalanced datasets. The method is based on modifying 1-norm SVM formulation to create a three objective optimization problem so as to incorporate into the formulation the error sums for the two classes independently. To solve it, we reduce the original formulation into two criteria variations and investigate the efficient frontier. The results of computational experiments are discussed.

Vehicle and Crew Scheduling

Stream: Optimization in Public Transport

Invited session

Chair: Natalia Kliwer, Information Systems and Operations Research, University of Paderborn, Warburger Str. 100, 33100, Paderborn, Germany, kliwer@upb.de

1 - A decomposition approach for the integrated vehicle-crew-rostering problem

Ana Paia, DEIO/CIO, University of Lisbon, Portugal, ampaia@fc.ul.pt, Marta Mesquita, Margarida Moz, Margarida Pato

The integrated vehicle-crew-rostering problem (VCRP) aims to assign, during a given time horizon, the drivers of a public transit company to the vehicle blocks built according to the daily demand of passengers in a specific area. We propose a Benders decomposition approach that iterates between the solution of an integrated vehicle-crew scheduling problem and a solution of a rostering problem, to obtain feasible solutions for the VCRP. Computational experience has shown that this approach leads to a pool of diverse feasible solutions where a large number of efficient solutions may be found.

2 - Aspects of real-world vehicle scheduling problems and their solution

Stefan Bunte, Warburger Straße 100, 33100, Paderborn, Germany, bunte@dsor.de, Natalia Kliwer

We consider the vehicle scheduling problem arising in public transportation companies and its practical extensions as the well known multiple depot multiple vehicle type vehicle scheduling problem. We would like to give a short overview on proposed solution approaches and will discuss different real-world and artificially generated problem instances and how their different characteristics affect state-of-the-art solution methods. We will present a new solution approach which is based on an aggregated time-space network model and show how it supports planners in public transport.

3 - Vehicle and crew scheduling with irregular timetables

Boris Amberg, DS&OR Lab, Faculty of Business Administration and Economics, University of Paderborn, Warburger Str. 100, 33098, Paderborn, Germany, boris.amberg@dsor.de, Natalia Kliwer
In public bus transport, many approaches have been developed to get vehicle and crew schedules with minimum cost. However, there are still needs concerning the quality of vehicle and crew schedules. Usually timetables consist of many trips serviced every day. But there are also trips that do not repeat daily. Scheduling vehicles and crews day after day produces schedules which have minimum cost but differ from each other, whereas similar/regular schedules are desired in practice. We discuss different approaches to improve the regularity of crew and vehicle schedules.

4 - A network flow optimization model for integrated capacity-based crew scheduling

Taieb Mellouli, Business Information Systems and Operations Research, University of Halle, Universitätsring 3, 06108, Halle Saale, mellouli@wiwi.uni-halle.de

Charter carriers such as TUIfly operate their flight schedules by crew stationed unevenly in multiple domiciles in order to cope with seasonal changes and changing touristic departure airports, hubs and destinations. In order to generate flyable pairing lines under these circumstances, an integrated approach for pairing (chain) optimization is realized incorporating time-dependent crew availability and exact crew transfers. The underlying network flow optimization model is superior to known set-partitioning approaches and is flexible enough to be applied for long-term crew stationing analyses.

WA-09

Wednesday 08:00-09:20
GSI - S 5

Transport Workforce Scheduling I

Stream: Timetabling and Rostering
Invited session
Chair: Dilay Çelebi, Management Engineering, Istanbul Technical University, ITU Isletme Fakultesi Macka, 34367, Istanbul, Turkey, celebid@itu.edu.tr

1 - Pilot crew rostering at Brussels Airlines: feasibility study and policy decisions
Broos Maenhout, Tweekerkenstraat 2, 9000, Gent, Belgium, Broos.Maenhout@UGent.be, Mario Vanhoucke

The adoption of EU/OPS 2008 regulations raised many questions for the management of Brussels Airlines involving the construction of feasible rosters with the needed number of pilots and the required productivity ratio per crew member. At the same time, the pilot union had some major concerns about the pilot workload and working conditions. We developed a flexible optimization tool that is used as a simulation tool in the negotiation process between Brussels Airlines and the labour union. A wide range of scenarios was tested in order to determine the appropriate mix of pilot rostering rules.

2 - Personnel scheduling problem with high diversity of shifts
Zdenek Hanzalet, Technicka 2, 16627, Prague, Czech Republic, baumezl@fel.cvut.cz, Premysl Sucha, Zdenek Hanzalet

We introduce a problem of personnel scheduling (staff timetabling) motivated by a real problem at The Air Navigation Service of the Czech Republic. The problem is similar to classical Nurse Rostering Problem (NRP), but there are more shift types (about 60), which leads to bigger state-space. There are some specific constraints like 'block sequence of shifts' constraint which is a more restrictive version of 'consecutive working days' constraint from NRP. We formalize the problem and we propose several heuristics solutions that are evaluated on a set of benchmarks.
3 - An introduction to the personnel planning problem of the Belgian railways

Burak Bilgin, Gebroeders Desmetstraat 1, 9000, Gent, burak.bilgin@kahosl.be

The personnel planning problem of the Belgian Railways is a complex problem with different layers and dimensions. A huge set of tasks are supposed to be assigned to the railway personnel with respect to location constraints, work regulations, and employee preferences. The task of being tackled with various metaheuristics, including Variable Neighbourhood Search and Simulated Annealing. The preliminary results are promising. The problem and the solution methods will be reported in greater detail at the conference, and benchmark data on the problem will be made public on the internet.

WA-10

Wednesday 08:00-09:20
GSI - S 6

Vector and Set-Valued Optimization I

Stream: Vector and Set-Valued Optimization

Invited session

Chair: Bienvenido Jiménez, Departamento de Matemática Aplicada, UNED, Calle Juan del Rosal, 12, 28040, Madrid, Spain, bjimenez@ind.uned.es

1 - Efficiency under pseudoinvexity and duality in nonsmooth multiobjective problems. a characterization

Manuel Arana Jimenez, Estadistica e Investidugacion Operativa, University of Cadiz, C/Chile, 1, 11002, Jerez de la Frontera, Cadiz, Spain, manuel.arana@uca.es, Gabriel Ruiz-Garzón, Rafaela Osuna-Gómez, Antonio Ruthán-Lizana

We establish characterizations for efficient solutions in nonsmooth multiobjective programming problems, which generalize recent characterizations for differentiable multiobjective programming problems. We prove that in order for Kuhn-Tucker or Fritz John points to be efficient solutions it is necessary and sufficient that the nonsmooth multiobjective function problems belong to new classes of functions, which are introduced by us, and illustrated by an example. We study the dual problem and establish weak, strong and converse duality results.

2 - Characterization of efficient solutions in non-regular vectorial optimization programming problems

Beatriz Hernández, Economics, University Pablo de Olavide, Edificio Nº 3, José Moñino - 2ª planta-despacho26, Ctra. de Utrera, Km. 1-41013 Sevilla, 41013, SEVILLA, Spain, mbhernjim@upo.es, Manuel Arana Jimenez, Rafaela Osuna-Gómez, Antonio Ruthán-Lizana

We give necessary optimality conditions for a multiobjective problem whose constraints don’t verify any constraint qualification, basing on Izmaïlov’s description of the tangent cone in the 2-regular case. To ensure that the optimality conditions obtained are sufficient too in order to characterize the complete efficient solutions set we define a new generalized convexity notion. Besides, we prove the concept of generalized convexity gave here is the weakest to ensure the sufficiency of the optimality conditions presented.

WA-11

Wednesday 08:00-09:20
GSI - S 17

Environmental Management and MCDA

Stream: Multiple Criteria Decision Analysis

Invited session

Chair: Antonio Boggia, DSEEA, University of Perugia, Borgo XX giugno, 74, 06121, Perugia, boggia@unipg.it

1 - Implementation of multicriteria modules in a geographic information system: a case study

Antonio Boggia, DSEEA, University of Perugia, Borgo XX giugno, 74, 06121, Perugia, boggia@unipg.it, Gianluca Massi

This paper presents the implementation of multicriteria modules in an open source GIS system. Features, possible use and output of the following implemented modules are presented: r.mcda.electre; r.mcda.fuzzy; r.mcda.regime; r.roughset. To implement the algorithms GRASS 6.3 has been used, adding a specific module written in C language. In addition, the new module has been included in the GRASS toolbox, in QGIS 0.10. We present the application of one of the implemented modules to a case study on the choice of suitable areas for land application of wastewater from agricultural activities.

2 - Water use scenarios assessment using multicriteria analysis

Lucia Rocchi, DSEEA, University of Perugia, Borgo XX giugno 74, 06121, Perugia, lucia.roikki@unipg.it, Antonio Boggia
Increasing in water demand for off-stream uses in multipurpose water basins is in conflict with environmental and recreational uses. New scenarios in environmental policies and new requests from local communities involve the use of decision support systems to find an equilibrium between different uses. In this study a multiobjective decision analysis is applied to decision making in the choice of the best development scenario. Multicriteria approach is capable to integrate quality judgement and preference index to find the best solution for a sustainable local development.

3 - Measuring sustainability of poultry production systems: a multicriteria approach
Luisa Paolotti, DSEEIA, University of Perugia, Borgo XX Giugno 74, 06121, Perugia, Italy, luisa.paolotti@gmail.com, Antonio Boggia, Carla Cortina, Emanuele Novelli

We present a comparison among three different systems of poultry production, from an economic, social and environmental perspective. We show that the triangular lattice is optimal if at least 68% of facilities are closed independently at random, assuming that facilities are closed. As an application of the kth nearest distance distributions and the average kth nearest distances for three regular point patterns: square, triangular, and hexagonal lattices. As an application of the kth nearest distance, a facility location problem with closing of facilities is considered. The problem aims to find the optimal regular pattern that minimizes the average distance to the nearest open facility. Assuming that facilities are closed independently and at random, we show that the triangular lattice is optimal if at least 68% of facilities are open.

3 - Structuring risk in multi-criteria terms
Theodor Stewart, Statistical Sciences, University of Cape Town, Upper Campus, 7701, Rondebosch, South Africa, theodor.stewart@uct.ac.za

Decision making with single or multiple objectives typically also involves various risk components. Simple expectation or mean-variance models do not adequately represent decision maker preferences in many contexts. We discuss a number of structures for representation of risk components in multicriteria modelling terms. These structures are compared on the basis of implicit biases each may introduce into the decision process, and recommendations are made concerning the use of scenarios and/or different values at risk.
This study formulates equity location models using the sum of absolute deviations, one of the simplest measures discussed. That is, it seeks facility locations where the sum of absolute differences between all pairs of facility-inhabitant squared distances is minimized. As efficiency measure we consider two cases, depending on the type of facility. For locating an attractive facility we use a Weber problem, for an obnoxious facility an anti-Weber problem. Combining the equity measure with each efficiency measure, two bicriteria models are obtained and studied here.

4 - Fuzzy approach to planar multi facility location-allocation

Amirhossein Sadoghi, Department of Management and Engineering, Linköping University, Bjornkarrsgatan 1 A Lgh 21, 584 36, Linköping, Sweden, amina242@student.liu.se

In this paper we propose fuzzy approach to solve the Location-allocation problem. Passing of the restriction of zero and one to assign customers, is highlighted in this research which is main assumption in formal location allocation problem. with using fuzzy c-means clustering algorithm measures the quality of configuration is used to locate the facility and how much it can serve its customers. We using planar topological structure, and unconstrained facilities. This research is an axiomatic research and try to prove validity and also reliability for using in empirical research.

3 - A state space representation of generalised order up to policies

Anthony White, Engineering and Information Sciences, Middlesex University, The Burroughs, Hendon, NW4 4BT, London, a.white@mdx.ac.uk, Michael Censlive

Lebani et al (2006) devised a controllable state space model for a general APVIOBPCS production and inventory system. However, this procedure did not cater for production delays of other than one time unit. We devised a model that allows for any value of production delay. This model allows a conversion from a discrete time input-output model using an exponential production delay with no loss of generality and is fully controllable and observable. Stability of these models can be obtained from the system eigenvalues and agree with previously published stability boundaries by us.

2 - A better synchronization in the single-vendor multi-buyer integrated inventory supply chain

Amirhossein Sadoghi, Department of Management and Engineering, Linköping University, Bjornkarrsgatan 1 A Lgh 21, 584 36, Linköping, Sweden, amina242@student.liu.se

In this paper we propose fuzzy approach to solve the Location-allocation problem. Passing of the restriction of zero and one to assign customers, is highlighted in this research which is main assumption in formal location allocation problem. with using fuzzy c-means clustering algorithm measures the quality of configuration is used to locate the facility and how much it can serve its customers. We using planar topological structure, and unconstrained facilities. This research is an axiomatic research and try to prove validity and also reliability for using in empirical research.

1 - Competition and collaboration in a service parts management system

Meriçcan Usta, Industrial Engineering, Middle East Technical University, 06531, Ankara, Turkey, mericcanusta@gmail.com, Secil Savasanerli, Yasemin Serin

We study the inventory management policies of two dealers in a service parts system. Dealers operate independently but collaborate by requesting service parts from each other. Dealers also get engaged in competition, since if a dealer requests a part from the other, the revenue has to be shared. Using Markov Decision Process we determine each dealer’s optimal policy. Due to complexity of the optimal policy, we suggest a simpler operating policy using notions of policy iteration. A game theoretical approach is taken to determine each dealer’s best response policy and the possible equilibria.

2 - A better synchronization in the single-vendor multi-buyer integrated inventory supply chain

Md Abdal Hoque, Department of Mathematics, University of Southern Denmark, Campusvej 55, 5230, Odense, Denmark, marco@imada.sdu.dk

Researchers have synchronized the single-vendor single-buyer integrated inventory supply chain by partial lots (equal and/or unequal) transfer and obtained optimal solution to the system. However, such synchronization in the single-vendor multi-buyer case for a generalized optimal solution is unavailable. Here we develop a generalized single-vendor multi-buyer supply chain model by extending an idea of synchronization of the single-vendor single-buyer case, and then present its optimal solution technique. The solution technique has been validated with the solutions of some numerical problems.

66041, Saarbrücken, Germany, mblaeser@cs.uni-sb.de
Timetabling at universities may require solving a series of complex problems rather than a single one. This includes creating balanced curricula, scheduling mandatory and elective courses and assigning exams. We focus on balanced curriculum timetabling and post-enrollment course timetabling, and point out similarities and differences in the models. We present some recent results in solving these problems by IP and effective heuristics. Further, we use a multiattribute experimental methodology for studying the effects of solver and problem’s features.

3 - Approximability of traveling salesman problems

Markus Bläser, Informatik, Universität des Saarlandes, 66041, Saarbrücken, Germany, mblaeser@cs.uni-sb.de

Many variants of the Traveling Salesman Problem are NP-hard and among them, many are even hard to approximate. For symmetric TSP with triangle inequality, the well-known Christofides algorithm still achieves the best approximation ratio. For the asymmetric case, the algorithm by Frieze, Galbiati & Maffioli was the best one for many years. In the recent years, some progress has been made here. We will give an overview over these algorithms, the underlying techniques, and present some open questions. In this talk, we will outline the development of the last few years.
Malaysian football is witnessing a decrease in the number of stadium supporters. Therefore, scheduling matches in timeslots that maximise the number of supporters is becoming a priority for the league administrators. We hypothesise that spectators would prefer to watch matches at stadiums if they are more important. Therefore, we propose to define a level of importance for each fixture. The Analytic Hierarchy Process (AHP), a theory of relative measurement with absolute scales, will be applied to obtain these importance levels. The outcome will be used as input to an optimisation model.

**Discrete-continuous scheduling**

Stream: Scheduling under Resource Constraints

Invited session

Chair: Jan Weglarz, Institute of Computing Science, Poznan University of Technology, ul Piotrowo 2, 60-965, Poznan, jan.weglarz@cs.put.poznan.pl

1 - Maximization of the net present value in some discrete-continuous project scheduling problems

Grzegorz Waligora, Institute of Computing Science, Poznan University of Technology, Piotrowo 2, 60-965, Poznan, Poland, gwaligora@cs.put.poznan.pl, Jan Weglarz

Some discrete-continuous project scheduling problems with discounted cash inflows are considered, in which number of discrete resources is arbitrary, and there is one continuous, limited, renewable resource. The processing rate of each non-preemptable activity is a continuous, increasing, and convex function of the amount of the continuous resource allotted to the activity at a time. The objective is to maximize the net present value. It is shown that sequential schedules are optimal for the considered problems. Some rules of optimal activity sequencing are proved for a few payment models.

2 - The problem of allocating resources of a grid to workflow applications.

Marc Mika, Institute of Computing Science, Poznan University of Technology, ul Piotrowo 2, 60-965, Poznan, Poland, Marek.Mika@cs.put.poznan.pl, Grzegorz Waligora, Jan Weglarz

The problem of allocating resources of a Grid to workflow applications is considered. This kind of jobs consist of several precedence related tasks. Each task can be executed in one of several modes. Grid resources are divided into computational and network resources. Two types of tasks are considered: computational tasks, which require computational resources, and transmission tasks, which require network resources. Some assumptions necessary to construct a model of the problem, the proposed model, and an exact approach to find all feasible solutions are presented.

3 - A deterministic scheduling problem in green computing

Rafal Rozyczki, Institute of Computing Science, Poznan University of Technology, ul Piotrowo 2, 60-965, Poznan, Poland, rafal.rozycki@cs.put.poznan.pl

We consider a machine scheduling problem where energy is treated as a doubly-constrained resource required to perform a set of jobs in a computer system. The performance enhancement of a system and energy savings are possible because the relation-processor speed vs power is nonlinear. This relation is modelled by a continuous speed function. The objective is to find a time-optimal schedule for an instance of the problem where an amount of energy and a constant limit of power are known and given. We show properties of optimal solutions and propose a heuristic algorithm to solve the problem.
Our work aims to investigate two groundwater inventory management schemes with multiple users in a dynamic game-theoretic structure. In the centralized scheme, users are allowed to pump water from a common groundwater aquifer with the supervision of a social planner, and in the decentralized scheme, each user is allowed to pump water independently from other users. We consider non-identical users distributed in two different layouts for the groundwater transmission, the strip transmission, and the ring transmission. In each layout, we analyze the groundwater inventory system centrally and decentrally.

**WA-18**

**Wednesday 08:00-09:20**

Lenné

Semidefinite Programming and Approximate Algorithms

**Stream:** Mathematical Programming

**Invited session**

Chair: Michel Baes, IFOR, ETH, HG.G.22.1, Ramistrasse 101, 8092, Zurich, Switzerland, michael.baes@ifor.math.ethz.ch

1 - Reduction techniques for spd relaxations of polynomial optimization problems

Martin Mevissen, Tokyo Institute of Technology, Ookayama 2-12-1-W8-29, Meguro-ku, 152-8552, Tokyo, martime6@is.titech.ac.jp, Masakazu Kojima

SDP relaxations for a polynomial optimization problem (POP) have been constructed by Lasserre and Waki et al. Still, the size of the sparse SDP relaxation remains the major obstacle to solve POPs of higher degree. An approach to transform general POPs to quadratic optimization problems (QOPs) is proposed, that reduces the size of the SDP relaxation substantially. We introduce different heuristics resulting in equivalent QOPs and show how sparsity of a POP is maintained under the transformation. As the most important issue we discuss how to increase the quality of the SDP relaxation for an QOP.

2 - A fresh view on the multiplicative weights update method

Michael Bürgisser, IFOR, ETH, HG G 22.4, Rämistrasse 101, 8092, Zürich, Switzerland, michael.buergisser@ifor.math.ethz.ch, Michel Baes

Multiplicative weights update (MWU) method was studied among others by Arora, Hazan, and Kale. It generalizes Littlestone and Warmuth’s weighted majority algorithm from learning theory. We show that MWU method is an instance of Nesterov’s primal-dual subgradient method. As a direct consequence of the results presented by Nesterov, we derive a new update rule for the MWU method. Vice versa, the setting of the MWU method gives an intuitive description of Nesterov’s algorithm.

3 - Approximative estimate sequence schemes

Michel Baes, IFOR, ETH, HG.G.22.1, Ramistrasse 101., 8092, Zurich, Switzerland, michel.baes@ifor.math.ethz.ch

In 1983, Nesterov proposed a class of schemes to minimize a convex function with a Lipschitz continuous gradient. These schemes, based on the concept of estimate sequences, are provably the fastest possible for such very large scale convex problems, if only first-order information is available. At each iteration, we must evaluate the gradient of the objective function and solve two auxiliary optimization problems. We determine how precisely we need to compute the gradient and the solution of these subproblems in order to get a reasonably accurate output of the algorithm.

**Multiobjective metaheuristics**

**Stream:** Metaheuristics

**Invited session**

Chair: Sebnem Demirkol, Industrial Engineering, Dokuz Eylul University, Dokuz Eylul University Department of Industrial Engineering, Tinaztepe Campus Buca, 35160, Izmir, Turkey, sebnem.demirkol@deu.edu.tr

1 - Use of multiobjective algorithms for scheduling jobs in large scale grid applications

Juan Arturo Perez Cebérreros, Grid Computing, CIC-IPN, Col. Nueva Industrial Vallejo, C.P. 07738 Mexico, D.F. Mexico, 75476, D.F., DF, Mexico, perezceberros@hotmail.com

Scheduling is a key problem in emergent computational systems, such as Grid and P2P, in order to benefit from the large computing capacity of such systems. In this paper we present a Multi-Objective Particle Swarm (MOPSO) based schedulers for efficiently allocating jobs to resources in a Grid system. The extensive experimental study showed that our MOPSO-based schedulers outperform existing GA implementations in the literature for the problem and also revealed their efficiency when makespan and flowtime are minimized.

2 - Multi-objective evolutionary meta-heuristic optimization

Sebnem Demirkol, Industrial Engineering, Dokuz Eylul University, Dokuz Eylul University Department of Industrial Engineering, Tinaztepe Campus Buca, 35160, Izmir, Turkey, sebnem.demirkol@deu.edu.tr, G. Mirac Bayhan

Single-objective optimization problem has attracted the scientists’ interest for a few decades. In single-objective optimization methods, the problem is described by only one objective function. However, in today’s highly competitive global business environment there are many objectives for companies. Also there may be some conflicting objectives in such a real life model. As a result, this kind of problems should have more than one objective function. In this study, we are going to make comparisons between our meta-heuristic approaches.
1 - Analysing the socio-economic potential of rural areas: a DEA-based approach for the valencian region (spain)

Ernest Reig, Applied Economics II, University of Valencia, Facultat d’Economia, Avda.dels Tarongers s/n, 46022, Valencia, ernest.reig@uv.es

Rural areas are considerably heterogeneous with regard to their socio-economic characteristics, a fact not always recognized in rural development planning. This paper shows how a Multi-Criteria DEA Model (MCDEA) can be used for the construction of a composite index of local socio-economic potential. This model offers a higher discrimination power than conventional DEA, in order to assess the diversity of potential displayed by rural municipalities. MCDEA, and a conventional DEA model are applied to data from 48 municipalities belonging to the Leader+ Program Zone of the Valencian Region.

2 - Travel agency productivity change: a case study in Alicante, spain.

Ramón Fuentes, Applied Economic Analysis, University of Alicante, Fac. de经济icas, Ap. 99, E-03080, Alicante, Spain., E-03080, Alicante, Spain, rfuentes@ua.es

This study analyses the development of productivity growth of 22 travel agencies based in Alicante (Spain) over the period 2004-2007. This analysis is carried out by using Malmquist Productivity Indices that can be broken down into three different components (Pure, Scale and Technological Efficiency Change) and a sensibility analysis of the results relative to sampling variations of the frontier (bootstrapping). Finally, using the Mann Whitney-U Test, the relationship between the levels of productivity of these agencies and their ownership type, location and level of experience are examined.

3 - A DEA based clustering approach as a classification tool for multiple criteria decision analysis: an application to world university rankings

Kazim Burş Atıcı, Dep.of Business Administration, Hacettepe University, Beytepe Campus/Çankaya, 06532, Ankara, kba@hacettepe.edu.tr, Aydin Ülucan

A widely applied sorting methodology, UTADIS (Utilities Additives Discriminates) requires a predefined classification of a set of alternatives. This classification is obtained through a single classification criterion. However, some real world problems may require consideration of more than one classification criteria. In this study, we aim to propose the use of a DEA based clustering approach with these varying classification criteria and to take the classification obtained through this analysis as predefined classes of UTADIS in the evaluation of world universities’ performance.

4 - Expert-oriented monte-carlo dea: technical efficiency assessment of the agrarian sector

Carlos Ramón Garcia Alonso, Management, ETEA, Business Administration Faculty. University of Córdoba, Spain, Escritor Castilla Aguayo 4, 14004, CORDOBA, CORDOBA, Spain, cgarcia@etea.com, Mercedes Torres, César Hervás-Martínez

The interpretation of non-standard inputs and/or outputs (I/O) in Data Envelopment Analysis (DEA) is a problem to deal with when Monte-Carlo DEA is used to evaluate relative technical efficiency in complex environments. In this paper, a dynamic model to interpret I/O automatically in complex models generated by a Monte-Carlo engine is presented and evaluated. The relative technical efficiency of agrarian sub-sectors and sizes has been assessed.
1 - An application of AHP for inventory classification

Demet Bayraktar, ITU Faculty of Management Maçka, 34367, Istanbul, demet.bayraktar@itu.edu.tr, Dilay Çelebi

Maintenance operations play a crucial role in railway services for providing uninterrupted and high quality service to passengers. Fast and secure management of the spare parts inventory is an important factor for successful execution of the maintenance process. The purpose of this research is to extend the classical ABC analysis by developing a multi-criteria inventory classification approach for supporting the planning and designing of Istanbul Metropolitan Municipality Light rail system.

2 - Performance management in healthcare industry: an analytic hierarchy process model for assessing physician performance

Murat Albayrakoglu, Business Informatics Program, Istanbul Bilgi University, Kurtulus Deresi Cd. 47, Dolapdere, 34440, Beyoğlu, Istanbul, Turkey, albayrak@bilgi.edu.tr, Tuba Cullazoglu, Isik Gonenc

In this study, an Analytic Hierarchy Process (AHP) model to assess physician performance is presented. To develop the model, assessment criteria were discussed with physicians, clinical directors, and hospital administrators through a series of interviews. Based on the interviews, criteria were specified, organized, and used to design a questionnaire and conduct a field research. Upon the field research, an AHP model for the assessment of physician performance is suggested. An application of the model is presented, and implications, advantages, and limitations of the model are discussed.

3 - A quantitative method for administrative audit

Yuji Sato, Mie Chukyo University, Graduate School of Policy Science, 1846, Kubo, 515-8511, Matusaka, Mie, Japan, ysatoh@mie-chukyo-u.ac.jp

In an administrative audit, enhancing accountabilities and improving transparencies would be crucial issues for auditing organizations. In this study, we focused on the contribution ratio of projects to a measure in the audit, and formulated the quantifying scheme of the ratio in the auditing process by applying the analytic hierarchy process. Then we showed that the quantification of the ratio readjusted the refinements of the administrative audit through actual cases of a local government in Japan.

1 - Knowledge extraction in e-cogncracy

José María Moreno-jiménez, Grupo Decisión Multicriterio Zaragoza, Universidad de Zaragoza, Facultad de Económicas, Gran Via, 2, 50005, Zaragoza, Spain, moreno@unizar.es, Jesús cardénos, Carolina Gallardo, Juan Aguarón, María Teresa Escobar, Adrian Tonovich, Alberto Turón

E-cogncracy is a cognitive democracy oriented to the extraction and democratization of the knowledge related with the scientific governance of society. This paper deals with the conjoint use of quantitative (data mining) and qualitative (text mining) approaches to identify, from the e-discussion stage of its methodology, the arguments that support the decisions of the political parties and the citizens. The proposed methodology has been applied to a case study related with the potential location of the greatest leisure project in Europe (Gran Scala) at Aragón.

2 - Group memory support to collaborative decision making

AbdelKader Adla, IRIT - Université Paul SABATIER de Toulouse, 118 Route de Narbonne, 31062, Toulouse, Cedex 09, France, adla@irit.fr

The decision making processes involve groups performing periodic and repetitive activities. At each session, new sets of information may be generated. The composition of the decision-makers’ group, however, may change. New members need to learn how previous decisions were made and are likely to spend significant time in learning the decision context. This paper describes the integration of a group memory within our proposed Group Decision Support System where is stored the work of prior groups to provide additional information processing and collaborative decision making support.

3 - Applicability of simple additive weighting method with grey relations and comparison with other grey theory techniques

Edmundas Zavadskas, Research Institute of Internet and Intelligent Technologies, Vilnius Gediminas Technical University, Saulėtekio al. 11, 2054, Vlntiu, Lithuania, edmundas.zavadskas@adm.vtu.lt, Arturas Kaklauskas, Tatjana Vilutiene

Multi-attribute analysis is useful in many economical, managerial or constructional problems. The accuracy of performance measures in COPRAS method is usually assumed to be accurate. However, there is usually an uncertainty involved in all multi-attribute model inputs. We demonstrate how simulation can be used to reflect fuzzy inputs, allowing more complete interpretation. A case study is used to illustrate the concept of general contractor choice based on multiple attributes of efficiency with fuzzy inputs applying COPRAS-G. We conclude that this method is appropriate to use.

4 - An evidence-adaptive belief rule-based decision support system for clinical risk assessment in emergency care

Guilan Kong, Manchester Business School, m16 6pb, Manchester, guilan.kong@postgrad.mbs.ac.uk, Dong-Ling Xu, Jian-Bo Yang

In this paper, a clinical decision support system based on a recently developed new belief rule inference methodology using the evidential reasoning approach is described. The system is specific for clinical risk assessment, and it can handle different uncertainties in clinical practice. Moreover, the system keeps its knowledge base evidence-adaptive by providing a machine learning functionality. Validation of the system is conducted by a case study using a data set of patients with cardiac chest pain. The study results show that the system can provide accurate clinical decisions.
Extremal problems and applications II

Stream: Nonlinear Programming

Invited session

Chair: João Lauro D. Faco, Dept. of Computer Science, Universidade Federal do Rio de Janeiro, Rua Lasar Segall, 100 /109, A, 22611-100, Rio de Janeiro, RJ, Brazil, jlfdaco@ufrrj.br

1 - Improved navier-stokes solutions, for global aerodynamical shape’s optimization

Adriana Nastase, RWTH-Aachen, Lisset Street, 8, 52074 Aachen, Germany, 52074, AACHEN, nastase@laferro.rwth-aachen.de

2 - Time-cost trade off problem in pet networks and sdp relaxation

Mohammad Reza Peyghami, Math Department, K.N. Toosi University of Technology, Math. Department, K.N. Toosi University of Technology, P.O.Box 16315-1618, Tehran, Iran, 1513944717, Tehran, Iran, Islamic Republic Of, peyghami@optlab.mcmaster.ca

In this paper, we propose a new approach based on Semidefinite Programming (SDP) relaxation and Monte Carlo (MC) simulation technique to solve the Time-Cost Trade off Problem (TCTP) in PERT networks in which all activities are subjected to linear cost function and assumed to be exponentially distributed. In order to maximize the project completion probability in a predefined deadline based on a prespecified probability, we construct the TCTP as a nonlinear optimization problem with decision variables of activity mean durations.

3 - Derivative optimization and design

Hans-Jörg von Mettenheim, Leibniz Universität Hannover, Institut für Wirtschaftsinformatik, Königsworther Platz 1, 30167, Hannover, Germany, mettenheim@wi.uni-hannover.de, Michael H. Breiner

Derivative instruments like options allow market participants to manage risks. The creation of customer tailored derivatives is often manual. We propose a software-based approach. Our software optimizes boundary conditions of an option according to an error function. It uses a Crank-Nicolson scheme and non-linear optimization to solve and optimize the Black-Scholes partial differential equation. We present an option with constant Delta. Such options are easy to hedge for issuers and exhibit a behavior like a future for them.

4 - Optimal control approach to crude oil scheduling

Joao Lauro D. Faco, Dept. of Computer Science, Universidade Federal do Rio de Janeiro, Rua Lasar Segall, 100 /109- A, 22611-100, Rio de Janeiro, RJ, Brazil, jlfdaco@ufrrj.br, Fabio Fagundes

We present an optimal control model for scheduling crude oil transportation from tankers to the crude distillation unit. Transfer operations are carried out by flows from a source equipment (e.g. tank, tanker, pipeline or process unit) to a destination equipment; discrete yes/no decisions are modeled as bilinear constraints and the control variables are the flows from one equipment to another. This continuous model is applied to an example from the literature based on a real refinery, reaching a local optimal solution by an efficient Nonlinear Programming method.
Graph Algorithms II
Stream: Discrete Optimization
Contributed session
Chair: Bibiana Obregón, Posgrado de Ingeniería, UNAM, Loma del Convento No. 61, 01620, México, Distrito Federal, Mexico, b.obregon.q@gmail.com

1 - Optimizing quasi-locally quasi-adjoin graphs
Hacene Ai Haddadene, Faculty of Mathematics, Dept of Operations research, USTHB University, BP32 Bab ezzouar 16111, 16111, Algiers, Algeria, aiithaddadenehace@yahoo.fr

In this paper we introduce a Quasi-Locally Quasi-Adjoin graphs (QLQA graphs, graphs such that each induced subgraph has a vertex whose neighbourhood can be partitioned into at most two maximal cliques). First, we give polynomial combinatorial algorithms of recognizing and also of determining the maximum clique in QLQA graphs. Then, we give a polynomial combinatorial algorithm for w-coloring any perfect Quasi-Adjoin graph. Finally, we give an other polynomial combinatorial algorithm for w-coloring any perfect QLQA graph. These algorithms use the technique of the dichotomic exchange.

2 - Levelwise mesh sparsification for point-to-point shortest path queries
Yuichiro Miyamoto, Dept. of Information & Communication Sciences, Sophia University, Kioicho 7-1, Chiyoda-ku, 102-8554, Tokyo, Japan, miyamoto@sophia.ac.jp, Takeaki Uno, Mikio Kubo

We propose the levelwise mesh sparsification method for fast point-to-point shortest path queries in networks using preprocessed data. In our method, several sparse networks are obtained by preprocessing the original network, and the shortest path is found quickly by searching the shortest path in these sparse networks. The advantage of our method is that it can deal with negative costs and time-dependent costs, and uses only a small amount of memory. Computational experiments on real world data show the efficiency of our method in terms of computational time and memory usage.

3 - Mixed integer linear formulations for the minimum label spanning tree problem
Maria Eugénia Captivo, Universidade de Lisboa, Faculdade de Ciências e Centro de Investigação Operacional, Campo Grande, Bloco C6, Piso 4, 1749-016, Lisboa, Portugal, mecaptivo@fc.ul.pt, João Clímaco, Marta Pascoal

In the minimum label spanning tree problem each edge of the network is assigned with a label (such as a color) and it is intended to determine a spanning tree with the minimum number of different labels. This problem has applications in telecommunication or transportation networks. We introduce mixed integer formulations and prove that one of their linear relaxations always gives the optimal value. Computational experiments are presented and discussed. In order to compare the computational times, we also ran a C language implementation of an existent exact procedure for the same problem.

4 - Transport properties of complex networks for different assortativity levels: electric and max-flow
Bibiana Obregón, Posgrado de Ingeniería, UNAM, Loma del Convento No. 61, 01620, México, Distrito Federal, Mexico, b.obregon.q@gmail.com, Lev Guzmán

We present a study of transport in complex networks. In particular, in transport properties of scale-free and Erdos-Renyi networks and compare electric and max-flow cases. We construct scale-free networks with a given degree sequence, to estimate the distribution of conductances for different values of assortativity parameter. For the electric case and for one source/sink node, the distribution of conductances is related to the assortativity level. The max-flow case, multiple sources/sinks, changes in the local connectivity lead to a different flow value as a function of the number of sources.

WA-27
Wednesday 08:00-09:20
GSI - S 21
Warehouse design and performance
Stream: Facility Logistics
Invited session
Chair: René de Koster, Rotterdam School of Management, Erasmus University Rotterdam, Room T10-56, PO Box 1738, 3000 DR, Rotterdam, Netherlands, rkoster@rsrn.nl
Chair: Kees Jan Roodbergen, Rotterdam School of Management, Erasmus University, P.O. Box 1738, 3000 DR, Rotterdam, Netherlands, kroodbergen@rsrn.nl

1 - Queueing network analysis of a distribution center
Liqiang Liu, EURANDOM, Eindhoven Univ. of Technology, 1.03 Laplace Gebouw, Den Dolech 2, 5612 AZ, Eindhoven, liu@eurandom.tue.nl, Ivo Adan

In this paper we focus on queueing network modeling and performance evaluation of a distribution center (DC). The DC is equipped with automated storage and retrieval systems (AS/RS), which are modeled as bulk servers. The resulting model is a closed, multi-chain queueing network which does not possess a product form solution in general. We develop an efficient aggregation/disaggregation type approximation to compute major performance measures accurately. We conduct extensive numerical experiments to test the goodness of the method.

2 - The order-picking problem in a rectangular warehouse with turn costs
Melih Çelik, Industrial Engineering Department, METU, ODTU Endüstri Mahendisliği, Bölümü Oda: 326 ODTU, 06531, Ankara, Turkey, celik@ie.metu.edu.tr, Haldun Sural

The order-picking problem in a rectangular warehouse aims to pick all the items corresponding to an order while minimizing the distance travelled by the picker. In this study, we treat the number of turns as the objective function instead of distance travelled and provide polynomial-time algorithms for the warehouses without and with middle aisles respectively. We also consider the case where both the distance travelled and the number of turns are to be minimized in warehouses both without and with middle aisles. Computational results on this problem are also provided.

3 - Modeling goals and deadlines for enhancing worker performance
José Antonio Larco, Rotterdam School of Management, Erasmus University Rotterdam, Burgemeester Oudlaan 50 Room T10-34, 3062 PA, Rotterdam, jlarco@rsrn.nl, Kees Jan Roodbergen, René de Koster, Jan Dul

Federal, Mexico, b.obregon.q@gmail.com, Lev Guzmán
We present the potential use of setting goals for enhancing production efficiency and flexibility. We build a behavioral decision making model that is consistent with the current empirical results of goal-setting behavioral theory. Our model is capable of making testable predictions of the workers’ workplace under the influence of goals. The operational model shows the value of information of the workplace over time in providing insights as to how to set goals for enhanced performance. We test our model in a laboratory experiment and present initial results.

1 - A regime-switching regression model for hedge funds

Christina Erlwein, Department of Financial Mathematics, Fraunhofer ITWM, Fraunhofer Platz 1, 67663, Kaiserslautern, Germany, christina.erlwein@itwm.fraunhofer.de, Marlene Mueller

We develop a regime-switching regression model for hedge funds, which accounts for possible shifts in trading strategies. The factors in this model are governed by a Markov chain in discrete time and are able to switch between different regimes representing different states of the economy. Hedge fund indices are chosen as independent variables. A filtering technique for hidden Markov models is applied, recursive parameter estimates are calculated through a filter-based EM-algorithm. The switching regression model is implemented on hedge fund series and their trading strategies are analyzed.

2 - Optimal portfolio selection with stochastic exponential utility functions

Turan Bulmus, Industrial Engineering, Koc University, Rumelifeneri yolu Koc Universitesi, sariyer, 34450, Istanbul, Turkey, tbulmus@ku.edu.tr, Suleyman Otekci

We analyze a single-period portfolio selection problem where the investor maximizes the expected utility of the terminal wealth. The utility function is exponential, but the Pratt-Arrow measure of absolute risk aversion is random. It is known that the investor is risk-averse in wealth for exponential utility functions with a constant absolute risk aversion is random. It is known that the investor is memoryized. The operational model shows the value of information of the workplace over time in providing insights as to how to set goals for enhanced performance. We test our model in a laboratory experiment and present initial results.

3 - Some optimisation problems in stochastic pension plans

Griselda Deelstra, Mathematics, Actuarial Sciences, Université Libre de Bruxelles (U.L.B.), Boulevard du Triomphe, CP 210, 1050, Brussels, Belgium, griselda.deelstra@ulb.ac.be

As an example, we determine the optimal contribution rate of a stochastic defined benefit pension fund. The affiliate’s mortality is modeled by a jump process and the benefits paid in at retirement are function of the evolution of stochastic salaries. Assets of the fund are invested in cash, stocks and a rolling bond. Interest rates are driven by a Vasicek model. The objective is to minimize both the quadratic spread between the contribution rate and the normal cost, and the quadratic spread between the terminal asset and the mathematical reserve required to cover benefits.

4 - Real options pricing by numerical methods: an r & d project application

Jorge González, Industrial Engineering Department, University of Concepción, Edmundo Larenas 215, Fourth floor, *, Concepción, Bio Bio, Chile, jorgonz@udec.cl, Alejandro Andalait

Options pricing in project valuation have been solved by application of methods based in simulation, lattice methods and finite differences, delaying the application of finite elements method, widely used in other fields of science. The finite elements method is studied and introduced like a numerical method that allows the resolution of real options pricing models, being an alternative that presents advantages in terms of convergence in relation to the finite differences methods. Finally, the abandonment and the expansion real option presents in a R & D investment project are valuable.

Energy and Environmental Market Modeling

Stream: Energy and Emission Markets

Invited session

Chair: Steven Gabriel, Civil & Env. Engin./ Applied Math and Scientific Computation Program, University of Maryland, 1143 Martin Hall, 20742, College Park, MD, United States, sgbriel@umd.edu

1 - Gasmod-dynamic - a dynamic model of the European natural gas market and network

Franziska Holz, International Economics, DIW Berlin, Mohrenstr. 58, 10117, Berlin, Germany, fholz@diw.de

We develop a dynamic model of the European natural gas market and network. It is based on the GASMOD-Net model in which the natural gas flows are constrained by a network graph. We focus on endogenous investments in the transport infrastructure (pipelines, LNG facilities) in an open-loop approach. Applying the GASMOD-Dynamic model to a small, stylized data set of the European natural gas market shows the importance of the transit infrastructure between European countries, in particular in an imperfect market.

2 - A model for the global crude oil market using a multi-pool mcp approach

Daniel Huppmann, DIW Berlin, Mohrenstraße 58, 10117, Berlin, Germany, dhuppmann@diw.de

This paper proposes a partial equilibrium model to describe the global crude oil market. Pricing on the global crude oil market is strongly influenced by price indices such as WTI (USA) and Brent (Northwest Europe). We adapt a modeling approach for pool-based electricity markets, in order to capture the particularities of these benchmark price indices and their influence on the market of physical oil. We use this approach to investigate market power of OPEC and compare this modeling approach to bilateral trade relations as is traditionally used in models of energy markets.
WA-30

Solution Methods in Nonsmooth Optimization

Stream: Nonsmooth Optimization and its Applications

Invited session

Chair: Refail Kasimbeyli, Industrial Systems Engineering Department, Izmir University of Economics, Sakarya Caddesi 156, Balcova 35330, Izmir, TURKEY, 35330, Izmir, refail.kasimbeyli@ieu.edu.tr

1. A derivative free solution algorithm in nonconvex optimization

Refail Kasimbeyli, Industrial Systems Engineering Department, Izmir University of Economics, Sakarya Caddesi 156, Balcova 35330, Izmir, TURKEY, 35330, Izmir, refail.kasimbeyli@ieu.edu.tr

In this paper we continue to study the Modified Subgradient (MSG) algorithm previously suggested by R. Gasimov for solving the nonconvex optimization problems. This algorithm is based on primal-dual relations and uses the sharp augmented Lagrangian dual scheme. The new algorithm does not require finding global minimum of the augmented Lagrangian at each iteration for updating the cutting angle method.

2. An efficient algorithm for solving d.c. programs based on the cutting angle method

Albert Ferrer, Dept. of Applied Mathematics I, Technological University of Catalonia, Av. Doctor Marañón, 44-50, 08028, Barcelona, Catalunya, Spain, alberto.ferrer@upc.edu, Gleb Beliakov

By adapting the Cutting Angle method in such a way that only values of the objective function are used we describe a new global optimization algorithm for solving d.c. programs, in which the objective function is a difference of convex functions. Applications of such an algorithm to mathematical programming problems are described and computational results are presented. Solutions obtained with another d.c. optimization package that uses subgradients are also included and their results compared.

3. Generalized subgradient algorithm for nonsmooth, nonconvex optimization

Adil Bagirov, School of Information Technology & Mathematical Sciences, University of Ballarat, University Drive, Mount Helen, P.O. Box 663, 3353, Ballarat, Victoria, Australia, a.bagirov@ballarat.edu.au, Julien Ugon, Ali Hakan Tor

In this paper a new algorithm for minimizing locally Lipschitz continuous functions is developed. Descent directions in this algorithm are computed by solving a system of linear inequalities. The convergence of the algorithm is proved for quasidifferentiable semismooth functions. We present the results of numerical experiments. We also compare the proposed algorithm with two different versions of the subgradient method using the results of numerical experiments.

4. Conjugate duality in nonconvex vector optimization

Yalcin Kucuk, Department of Mathematics, Anadolu University, anadolu Universiteleri Fen Fakultesi Matematik Bolumu, 26470, Eskisehir, ykucuk@anadolu.edu.tr, Ilknur Atasever, Mahide Kucuk

In this work, by using a special vectorial norm, we defined conjugate and biconjugate maps of a set valued map. In addition, a new subdifferential of nonconvex set valued map is defined and existence theorems for subdifferentiability of a nonconvex set valued map are given. Relations between conjugate map, biconjugate map and subdifferential are examined. Conjugate dual problem of the vector optimization problem is defined, weak duality and strong duality theorems are given.

WA-31

Data Mining and Decision Making 1

Stream: Data Mining and Decision Making

Invited session

Chair: Lai-Soon Lee, Laboratory of Applied and Computational Statistics, Universiti Putra Malaysia, Institute for Mathematical Research, Universiti Putra Malaysia, 43400, UPM Serdang, Selangor, Malaysia, lee@math.upm.edu.my

1. An experimental comparison of classification algorithms for imbalanced credit scoring data sets

Iain Brown, School of Management, University of Southampton, University of Southampton, University Road, SO17 1BJ, Southampton, I.Brown@soton.ac.uk, Christophe Mues

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This paper sets out several techniques that can be used in the analysis of imbalanced data sets from a credit scoring perspective. Imbalanced data sets occur when the number of defaulting observations are significantly lower than those which do not default. As well as using traditional classification techniques, such as logistic regression, linear and quadratic discriminant analysis, neural networks and decision trees this paper will also explore the suitability of gradient boosting, least square support vector machines and random forests.

2 - Price forecasting in the used car market
Mariana Listiani, Information and Media Technology, TU Hamburg Harburg, Handweg 17a, 21077 . Hamburg, Germany, mariana.listiani@gmail.com, Stefan Lessmann
The paper develops a data-driven approach to support decision making in the car leasing industry. In order to determine a profitable yet competitive leasing rate, an accurate prediction of a car’s residual value after the leasing period is required. To achieve this, a forecasting methodology based on support vector regression and evolutionary strategies is proposed. The model’s potential is examined by means of empirical experimentation using real-world data from a leading German car manufacturer.

3 - Loss given default modelling for mortgage loans
Mindy Leow, School of Management, University of Southampton, University of Southampton, University Road, SO17 1BJ, Southampton, m.leow@soton.ac.uk, Christophe Mues, Lyn Thomas
We propose the combination of a Probability of Repossession (given default) Model and a Haircut (given repossession) Model, where probabilities of repossession and non-repossession are weighted against respective predicted loss values to get an estimate for Loss Given Default (LGD). We find the Probability of Repossession Model should comprise of more than just the commonly used loan-to-value ratio, and that estimation of LGD benefits from the Haircut Model which predicts the discount the sale price of a repossessed property consistently undergoes.

4 - Comparison of single and mixture distribution models for modelling lgd
Jie Zhang, School of Management, University of Southampton, Quantitative financial risk management centre, Building 2, Highfield Campus, Southampton, SO17 1BJ, Southampton, jz3g08@soton.ac.uk
Estimating Recovery Rate and Recovery Amount has taken a more importance in consumer credit because of both the new Basel Accord regulation and the increase in number of defaulters due to the recession. We examine whether it is better to estimate Recovery Rate or Recovery amounts. We look at the advantages and disadvantages of using single distribution model or mixture distribution models for default. We also investigate the ‘cash flow’ in recoveries and see how such a model aids decisions about when it is optimal to write off loans.

1 - The stable distributions, their parameter estimation, and financial application
Vadym Omelchenko, Faculty of Mathematics and Physics, The Charles University in Prague and UTIA, Kc Karlova 3, 121 16 Praha 2, The Czech Republic, UTIA: Pod Vodarenskou vezi 4 CZ-182 08, Praha 8, The Czech Republic, 121 16 , Prague, vadim224@yahoo.com
Stable distributions can be used as a generalization of the Gaussian law and the Wienier process. In financial practice the asset prices exhibit behavior that cannot happen under assumption that they are ruled by the standard Wiener process. But the stable laws in many relations copy the normal one therefore, it is reasonable to replace the Gaussian model by its stable counterpart. The stable laws have 4 parameters and their estimation is very important task and there will be used the modified version of the maximum likelihood method and the methods based on characteristic function.

2 - Asymptotic expansions for the first four moments of the sparre anderson surplus process
Rovshen Aliyev, Department of Statistics and Computer Sciences, Karadeniz Technical University, a Karadeniz Technical University,Faculty of Arts and Sciences,Trabzon, Turkey, 61080, Trabzon, alievrt@mail.ru, Vafa Jafarova
In this study the surplus process is considered, where the number of events occurred until time t,N(t) an ordinary renewal process. The asymptotic expansions for large number of t for the first four moments of the surplus process are obtained. Furthermore, the asymptotic expansions for large t for the skewness and kurtosis of the process are established.

3 - Premium bounds for the cedent’s (reinsurer’s) total risk under reinsurance with dependent random retention levels
Eva-Maria Ortega, Centro de Investigacion Operativa, University Miguel Hernandez, Campus Orihuela, Ctra. de Beniel, km. 3,2, 03312 Orihuela, Alicante, Spain, evamaria@umh.es, Laureano Fernando Escudero
We analyze how dependencies influence the variability of retained and reinsured total claim amount, under reinsurance with random retention levels. Premium bounds are derived for several principles that are preserved by the variability and Laplace order. We consider an extension of the LCR model, with arbitrary random retention, obtaining comparisons of Laplace transforms of retained risk and Exponential premiums bounds. We extend this to the excess-loss, stop-loss reinsurance, for the variability ordering and the reinsured total risk. Criteria on the valuation of financial assets are derived.

4 - The non-monotonic effect of financing constraints on investment
Stefan Hirth, Aarhus School of Business, Aarhus University, Fuglesangs Alle 4, 8210, Aarhus, Denmark, stefanh@ash.dk, Marc Viswanatha
We analyze investment timing in a discrete-time framework with two possible investment dates, which is an extension of the model by Lyandres (2007). While Lyandres could only show non-monotonicity of investment in market frictions, we derive an investment threshold that is U-shaped in the firm’s liquid funds, a result similar to the infinite-horizon model by Boyle and Guthrie (2003). However, due to the tractability of our model, we can more clearly explain the relevant trade-offs leading to the U-shape.
Interval B&B Algorithms: Theory to Applications

Stream: Global Optimization

Invited session

Chair: Frederic Messine, ENSEEIHT-IRIT, 2 rue Camichel, 31000, TOULOUSE, France, Frederic.Messine@n7.fr

1 - On estimating workload in parallel branch-and-bound global optimization algorithms
Jose Luis Berenguel, Computer Architecture and Electronics, Universidad de Almeria, Ctra. Sacramento s/n, La Cañada de San Urbano, 04120, Almeria, Spain, jberenguel@gmail.com, L.g. Casado, I. Garcia, Eligius M.T. Hendrix

In general, solving Branch-and-Bound Global Optimization problems requires a huge computational capacity. These type of algorithms are examples of dynamic workload problems because the number of nodes we have to evaluate in the B&B tree isn’t known a priori. We are interested in load balancing strategies for Tree-based multiple pool algorithms. We present a new way of estimating the remaining running time of B&B algorithms dynamically. This will allow us to manage the load balancing in a multiprocessor environment. Illustrations are based on interval global optimization algorithms.

2 - Metaheuristic methodology based on interval branch and bound algorithms with a limitation of the memory
Jordan Ninin, Computer Science, IRIT-ENSEEIHT, 2 rue Camichel, 31000, Toulouse, France, Jordan.Ninin@n7.fr, Frederic Messine

The exponential complexity in time, and also in memory, of an Interval Branch and Bound Algorithm does not make it possible to solve some quite large problems. In this work, we propose a metaheuristic methodology based on an interval branch and bound algorithm which consists in fixing an upper bound on the available memory. During the computations, when this bound is reached, a heuristic is then used to limit the size of the data structure. With this metaheuristic frame, some heuristics are proposed and their efficiencies are compared and discussed by considering some numerical tests.

3 - Interval branch and bound algorithms for inverse problems of electromagnetic devices design
Julien Fontchastagner, GREEN, Nancy Université - INPL, ENSEM, 2 avenue de la Forêt de Haye, 54516, Vandoeuvre les Nancy, France, Julien.Fontchastagner@ensem.inpl-nancy.fr, Frederic Messine, Yvan Lefevre

Two extensions of an interval Branch and Bound algorithm (IBBA) for solving particular types of mixed constrained global optimization problems are presented. Indeed, this kind of methods needs analytical expressions of objective functions and constraints which must be relatively simple. Our work deals with two ways for solving our design problems: by adapting IBBA in order to deal with a more elaborate analytical model than those used usually; by extending IBBA to deal with the main equality constraint of type black-box which is issued from the computations of a finite element code.

4 - Global optimization via interval equations
Ioannis A. Nikas, Department of Mathematics, University of Patras, Univeristy Campus, 26 504, Rio, Greece, nikas@math.upatras.gr, Theodoula N. Grapsa, George S. Androulakis

In this paper, the problem of finding reliably and with certainty all minima of an interval optimization problem within a given search interval for continuously differentiable functions over real numbers is examined. A new formality of interval arithmetic is described in a theoretical manner to develop and prove a new method. Theoretical aspects of the proposed methodology are stated and proved. Finally, the method is tested on a set of test functions and promising theoretical results are verified.
4 - Association mining analysis of automobile spare parts sales: a case study

Gurdal Ertek, Faculty of Engineering and Natural Sciences, Sabanci University, Orhanli, Tuzla, 34956, Istanbul, Turkey, ertek@sabanciuniv.edu, Mehmet Can Arslan

We describe a project that we carried out at a major automobile distributor in Turkey. Spare parts sales for a particular model have been analyzed using association mining and graph visualization, and recommendations have been incorporated into the information system. We analyze the association patterns for the 5 months on which the recommendations are based, and compare them to the patterns encountered 1.5 months after the recommender system was put into practice. Numerous theoretical and practical challenges that have been encountered throughout the project will be presented.

4 - A witness version of the cops and robber game

Nancy Clarke, Mathematics and Statistics, Acadia University, 12 University Avenue, B4P2R6, Wolfville, Nova Scotia, Canada, nancy.clarke@acadiau.ca

The games considered are mixtures of Searching and Cops and Robber. The cops have partial information provided via witnesses who report sightings of the robber. The witnesses are able to provide information about the robber’s position but not the direction in which he is moving. The robber has perfect information. In the case when sightings occur at regular intervals, we present a recognition theorem for graphs on which a single cop suffices to guarantee a win. In a special case, this recognition theorem provides a characterization.

■ WA-35
Wednesday 08:00-09:20
GSI - S 9

Cops and Robbers
Stream: Graph Searching

Invited session
Chair: Boting Yang, Dept. of Computer Science, University of Regina, 3737 Wascana Parkway, S4S 0A2, Regina, Saskatchewan, Canada, boting@cs.uregina.ca

1 - Guarding games on graphs

Petr Golovach, Department of informatics, University of Bergen, PB, 7803, 5020, Bergen, Norway, Petr.Golovach@ii.uib.no, Fedor Fomin, Alex Hall, Deniel Lokshtanov, Mattus Mihalak, Elias Vicari, Peter Widmayer

We consider a problem of keeping a moving intruder out of a given area in a graph by blocking the ways of possible attacks by a team of mobile agents (guards). The intruder and the guards are placed on vertices of the graph; they take turns in moving to adjacent vertices (or staying). The goal of the intruder is to enter the guarded region at a vertex without guards. The problem is to find the minimum number of guards needed to prevent this event. We consider two variants of the problem which differs by the order of players moves and establish a number of complexity and algorithmic results.

2 - Cops-and-robbers on infinite graphs

Gena Hahn, Informatique et recherche operationnelle, Universite de Montreal, 2920 Chemin de la tour, H3T1J8, Montreal, Quebec, Canada, hahn@iro.umontreal.ca

While the game of cops-and-robbers has been studied, sometimes intensely, over the past two decades for finite graphs, not much has been done for infinite ones. This talk will be a quick survey of some finite graph results leading to considerations of infinite ones where we mention some perhaps surprising results, some old, some new. Some of this work is in collaboration with Anthony Bonato, Francois Laviolette, Norbert Sauer, Claude Tardif end Robert Woodrow.

3 - Cops and robbers from a distance

Anthony Bonato, Mathematics, Ryerson University, 350 Victoria St, M5B2K3, Toronto, ON, Canada, abonato@ryerson.ca

In vertex pursuit games played on graphs such as Cops and Robbers, the cops must occupy the node of the robber to win. We present results on scenarios where the cops win if they are some prescribed distance from the robber. We study this new game—distance k Cops and Robber—from algorithmic, structural, and probabilistic perspectives.

■ WA-36
Wednesday 08:00-09:20
GSI - S 11

Stochastic Modelling and Simulation I
Stream: Stochastic Modelling and Simulation

Invited session
Chair: Andreas Rößler, Fachbereich Mathematik, TU Darmstadt, Schlossgartenstrasse 7, 64289, Darmstadt, Germany, roessler@mathematik.tu-darmstadt.de
Chair: Erik Kroapot, Department of Mathematics, Friedrich-Alexander University Erlangen-Nuremberg, Martensstraße 3, 91058, Erlangen, Germany, kroapot@am2.am.uni-erlangen.de

1 - Financial valuation of guaranteed minimum withdrawal benefit in variable annuities under correlated levy processes

Kwai-sun Leung, Systems Engineering and Engineering Management, The Chinese University of Hong Kong, Shatin, New Territories, Hong Kong, N.A., Hong Kong, Hong Kong, ksleung@se.cuhk.edu.hk

In annuity policy with guaranteed minimum withdrawal benefit (GMWB), the policyholder pays a single lump sum premium to the insurance company in return for a guaranteed stream of periodic withdrawals on a set of preset dates over the life of the contract. The received premium is then invested in a reference portfolio of assets which is usually a mutual fund. Periodic fees are charged for providing this guarantee.

In this paper, the price of this insurance policy when the underlying fund value and the interest rate process are driven by two-dimensional correlated Levy processes is derived.

2 - Probabilistic approach of serial multi-level production/inventory systems with finite capacities

Fouzia Baghery, LAMAV, Valenciennes University, Mont Houy, Valenciennes, F59304, valenciennes, France, fbaghery@univ-valenciennes.fr

Let us consider for a single product a serial system with finite capacities installations. Stochastic external demand arises at the lowest installation. At any time each level i places orders to level i+1, with some cost depending on i. We characterize the optimal cost as a maximum solution of quasi-variational inequalities. The existence and properties of optimal policy are given.
3 - Make-to-order systems with correlated demands
Michael Zazanis, Statistics, Athens University of Economics and Business, 76 Patission str., 10434, Athens, Greece, zazanis@aueb.gr
We examine markovian models of make-to-order systems when the demand stream is correlated. Explicit results are obtained for demand streams with exponential interarrival times and markovian dependence based on the bivariate exponential distribution. Exact and asymptotic results are also derived for multistage make-to-order systems and for assemble-to-order systems when the demand stream and the processing times are correlated.

4 - Estimating some effects of prioritizing aircraft landings at over-congested airports
Milan Janic, OTB Research Institute, Delft University of Technology, Jaffalaan 9, 2628BX, Delft, M.Janic@tudelft.nl
This paper investigates effects of prioritizing the aircraft landings at the over-congested runways as a short-term demand management measure similar to the congestion charging measure. The deterministic queueing model for estimating queues, delays, and related costs of particular prioritized aircraft categories (classes) is developed. The assignment of priorities to particular aircraft is based on the dynamic priority function designed to minimize the total cost of delays for all aircraft. The model is applied to a congested European airport using ‘what-if’ reasoning.

WA-37
Wednesday 08:00-09:20
GSI - S 12
Decision Theory and Analysis - 1
Stream: Decision Analysis
Contributed session
Chair: Hermann Jahnke, Fakultät für Wirtschaftswissenschaften, Universität Bielefeld, Universitätsstraße 25, 33615, Bielefeld, Germany, hjahnke@wiwi.uni-bielefeld.de

1 - Uta — nm: searching for non-monotonic utility functions
Tomas Kliegr, Department of Information and Knowledge Engineering, University of Economics, Prague, Faculty of Informatics and Statistics, Winston Churchill Sq.4, 13067, Prague, Czech Republic, tomas.kliegr@vse.cz, Lucia Nemethyova

UTA methods use linear programming for finding a model consisting of piecewise-linear additive partial utility functions assuming that stated preferences are monotonic. UTA-NM (Non-Monotonic) is inspired by UTA Star algorithm but allows non-monotonic partial utility functions if they decrease total model error. The shape of the functions is determined automatically while linearization techniques ensure balance between the error and simplicity of the model. The resulting program is still linear and convex. UTA-NM was applied on the analysis of preferences in the domain of transportation choice.

2 - Analyzing the effects of decision maker’s characteristics on the violations of expected utility theory
Amilcar Serrao, Management Department, Evora University, Largo dos Colegtais, 7000, Evora, Alentejo, Portugal, aserrao@uevora.pt
Expected utility theory has been tested by experimental studies which have been violating their axioms. This research work uses a structural equation modeling approach to evaluate the effects of biological, demographical and emotional characteristics of decision makers on the violations of expected utility theory. Model results show that there exist choice patterns which are inconsistent with EUT and this inconsistency may be explained by the differences of decision makers’ characteristics. Emotions might have the greatest influence how decision makers violate expected utility axioms.

3 - Lower price limits for full-service contracts based on almost stochastic dominance
Hermann Jahnke, Fakultät für Wirtschaftswissenschaften, Universität Bielefeld, Universitätsstraße 25, 33615, Bielefeld, Germany, hjahnke@wiwi.uni-bielefeld.de, Jan Thomas Martini
Capital equipment requires services like installation, maintenance, and repair. In a competitive environment it is a crucial part of the equipment manufacturer’s strategy to offer such industrial services. In this context, full-service contracts (FSCs) are increasingly important. We focus on risk issues when analyzing lower price limits of FSCs. The approach is based on the concept of almost stochastic dominance (ASD). It allows to model the choice of a lower price limit as a multi-person decision. Application issues discussed are, e.g., the implementation of ASD and a variable number of FSCs.

WA-38
Wednesday 08:00-09:20
GSI - S 13
Simulation Optimization
Stream: Simulation, Metamodeling and Optimization
Invited session
Chair: Gulser Koksal, Industrial Engineering, Middle East Technical University, 6531, Ankara, Turkey, koksal@ie.metu.edu.tr

1 - Robust simulation-optimization through taguchi’s approach and metamodels
Gabriella Dellino, Information Engineering Dept., University of Siena, Via Roma 56, Edificio S. Niccolò, 53100, Siena, Italy, dellino@dii.unisi.it, Jack Kleijnen, Carlo Meloni
Simulation-optimization aims to identify a combination of input parameters that gives optimal performance of a simulated system. This optimization usually ignores the uncertainty in the input factors, leading to suboptimal or infeasible solutions. We therefore propose a novel methodology for robust simulation-optimization, based on Taguchi’s worldview; it approximates the simulation input-output behavior through either linear regression or Kriging metamodels. Next, these metamodels are solved through Mathematical Programming. The methodology has already been applied to some inventory models.

2 - Multicriteria optimization for the performance of solid roket motor
Elcin Kartal, Statistics, Middle East Technical University, 06531, Ankara, Turkey, kartalelcin@gmail.com, Inci Battmaz, Gulser Koksal
Simulation optimization can be defined as the process of finding the best input variable values which optimize the output variable. The output of a simulation model is used by an optimization strategy to provide feedback on progress of the search for the optimal solution. In many real life optimization problems, however, multiple and/or conflicting objectives have to be taken into account. This paper examines some multicriteria optimization methods for optimising the performance of solid roket motor.
3 - Constrained optimization in simulation using kriging metamodeling

Inneke Van Nieuwenhuyse, Research Centre for Operations Management, K.U.Leuven, Naamsestraat 69, Office 04.112, 3000, Leuven, inneke.vannieuwenhuyse@econ.kuleuven.be, Jack Kleijnen, Wim van Beers

This paper presents a novel heuristic for constrained optimization of random simulation models. One output is selected as objective to be minimized, while other outputs must satisfy given target values. The heuristic uses Kriging metamodels to guide the search for the optimal parameter settings. The heuristic is applied to a call center simulation model, aiming to determine optimal capacity sizes (for operators and trunk lines) in order to balance resource costs and customer waiting costs.

4 - Operational fixed job scheduling problems with time limitations

Deniz Türsel Eliiyi, Department of Business Administration, Izmir University of Economics, Sakarya Cad. No:156, Balçova, 35330, Izmir, Turkey, deniz.eliiyi@ieu.edu.tr, Meral Azzioðlu

We present heuristics for the Operational Fixed Job Scheduling problem. Jobs should start processing as soon as they arrive. Working/spread time constraints limit operation times of machines. We propose greedy constructive algorithms and filtered beam search for the working time problem. For the spread time problem, Minimum Cost Network Flow (MCNF) and longest path solutions, decomposi-
tion by time, and a two-phase enumeration tree are used in three algorithms. Improvement algorithms apply to both problems. Computational experiment reveals that solutions to both problems are quite satisfactory.

WA-39

Wednesday 08:00-09:20
GS1 - S 14

Process Scheduling

Stream: Scheduling
Contributed session
Chair: Deniz Türsel Eliiyi, Department of Business Administration, Izmir University of Economics, Sakarya Cad. No:156, Balçova, 35330, Izmir, Turkey, deniz.eliiyi@ieu.edu.tr

1 - Multi-stage continuous production systems: planning and optimization issues
Krystsina Bakhrankova, Faculty of Economics, Informatics and Social Sciences, Molde University College, Britvegen 2, 6411, Molde, Norway, krystsina.bakhrankova@himolde.no

Despite their prevalence, continuous production systems are less researched in the literature. This paper explores relevant planning and optimization issues on a concrete industrial example of a multi-product continuous plant with non-discrete units and intermediate tanks. Thus, two multi-stage optimization models focused on, respectively, energy costs minimization and capacity maximization are developed, tested and analyzed. The models reflect the actual system: up- and downstream capacity restrictions, return flows and multiple processing alternatives, and provide substantial cost savings.

2 - Optimisation in food-processing industry: a case study
Veronika Skocdopola, Dept. of Econometrics, University of Economics Prague, Winchester Churchill sq. 4, 130 67, Prague 3, Czech Republic, veronika.skocdopola@vse.cz, Josef Jablonsky

The paper presents the model for optimisation of production of white masses (WMs) in the food-processing company. The problem is formulated as a blending problem with several special features. The optimisation criterion is minimisation of total costs. The most important constraints are requirements on composition of WMs, composition of raw materials and limits for surplus sales of materials. The results of the model offer recommendation for purchase, production and surplus sales of raw materials. DSS for company management based on the cooperation of MS Excel with LINGO solver is presented.

3 - A closed-loop approach to continuous process scheduling problems
Christoph Schwindt, Institute of Management and Economics, Clausthal University of Technology, Julius-Albert-Str. 2, 38678, Clausthal-Zellerfeld, Germany, christoph.schwindt@tu-clausthal.de, Hanno Sagebiel

We consider the scheduling of multistage continuous production plants. Starting from the decomposition into a planning and a scheduling problem, we present a closed-loop approach. Having computed a feasible production schedule, we return to the planning phase, where we re-optimize the operating conditions subject to the constraints of the scheduling problem. We then schedule the operations again and iterate the planning and scheduling phases until a fixed point is reached. The method is able to find good feasible schedules for complex benchmark instances within few minutes on a standard PC.

WA-40

Wednesday 08:00-09:20
GS1 - S 27

Governance and Development

Stream: OR for Development and Developing Countries
Invited session
Chair: Gerhard-Wilhelm Weber, Institute of Applied Mathematics, Middle East Technical University, ODTÜ, 06531, Ankara, Turkey, gweber@metu.edu.tr
Chair: Honora Smith, School of Mathematics, University of Southampton, Highfield, SO17 1BJ, Southampton, Hampshire, United Kingdom, honora.smith@soton.ac.uk

1 - Citizen adoption of e-government systems: a structural equation modelling application
Irfan Emrah Kanat, Informatics Institute, Middle East Technical University, 06531, Ankara, Turkey, ikekanat@gmail.com, Sevgi Ozkan

E-Government initiatives are increasing the convenience and accessibility of government services worldwide. Unfortunately not all e-government initiatives end up as being successful. A deeper understanding of the factors influencing citizens’ adoption behavior is required for the effectiveness of e-government implementations. The aim of this study is to develop a model for predicting and explaining citizen behavior regarding the acceptance of e-government systems in Turkey and validate it through the use of Structural Equation Modelling.

2 - Russian market of refuse collection: problems and perspectives
Mikhail Belousov, Microeconomics, SU-HSE, 20, Myasnitskaya, State —University Higher School of
Product liability as a subject of financial valuation

Peter Kurz, Ernst-Moritz-Arndt-Universität Greifswald, Friedrich-Loeffler-Straße 70, 17489, Greifswald, peter.kurz@uni-greifswald.de, Heinz Eckart Klingelhoefer

Product liability can have significant, long-term impact on a company through the cost of litigation, damages and market reactions. We present a model for the financial valuation of actions to reduce a manufacturers liability exposure. Investments in product safety, disinvestments, insurance and indemnification clauses can be considered. Interdependencies between production, sales, investment and finance are taken into account as well as uncertainty concerning batch failures, market reactions and possible product recalls. Sensitivity analysis is used to to assess the impact of changed settings.

The impact of macroeconomic announcements on stocks: why are some firms more sensitive than others?

Georg Bestelmeyer, Seminar für ABWL und Unternehmensfinanzen, Universität zu Köln, 50923, Köln, Germany, bestelmeyer@wiso.uni-koeln.de, Dieter Hess

Theory suggests that the stock market’s reaction to macroeconomic news depends on the news’ impact on growth expectations, risk free interest rates and risk premiums. On the the index level, Boyd et al. (2005) suggest that the impact of unemployment news depends on the stage of the business cycle. We analyze individual stocks, hypothesizing that companies whose earnings are more closely linked to the overall economy, react stronger to news about overall economic activity. Analyzing unemployment rates as well as nonfarm payrolls, we document strong stock price reactions on the individual level.

3 - Long term profitability assessment of open pit mining in intransparent markets: perspectives and case study

Thomas Burkhardt, Campus Koblenz, IFM, Universität Koblenz-Landau, Universitätstr. 1, 56070, Koblenz, Germany, tburkha@uni-koblenz.de, Alexander Hennig

Mining is a risky business, and the proper assessment of profitability is particularly difficult if we have to deal with commodities for which markets are highly localized and intransparent. We discuss, based on an actual case study of a gravel surface mining project, the essential issues involved in the evaluation. Our analysis highlights that in practical applications the limitations on available data are serious, so that a detailed modeling of the production process in connection with rather robust valuation techniques seem most appropriate.
In the Air Traffic Flow Management, the predictability is essential information in building schedules. Therefore, a high value is attached to predictability as it enables airlines and airports to improve the punctuality/financial performance trade-off. We propose a modeling for the predictability and flexibility of the Air Traffic Flow Management system. This modeling leads to a trade-off between the arrival rate of flights and the time window. We show one method to transform this trade-off to 0-1 optimization problem. The real data results are also presented.

3 - A dc programming approach for feature selection in support vector machines

Mamadou Thiao, Laboratory of Modelling, Optimization and Operations Research, LMI, National Institute for Applied Sciences of Rouen France, BP 08, Place Emile Blondel, 76131, Mont Saint Aignan, thiaoma@insa-rouen.fr, Tao Pham Dinh, Hoai An Le Thi

Feature selection consists of choosing a subset of available features that capture the relevant properties of the data. This paper presents a novel feature selection approach minimizing directly the classifier error while controlling the number of features selected. The main idea of our approach is the addition of a constraint for the number of features. The resultant problem is formulated as a DC program and handled by the DCA algorithm in DC programming. Experiments with various real-world data sets show that our method accomplishes the desired feature selection and classifier performance.

4 - Approximating risk in a large portfolio and empirical applications

Ba Chu, Economics, Carleton University, 1125 Colonel By Drive, Ottawa, K1S 5B6, Ottawa, Ontario, ba_chu@carleton.ca

This paper provides an asymptotic approach for the portfolio selection problem of an investor who desires to ensure himself from losing more than a specified amount, which is also called as the shortfall probability approach. We shed some light on the relationship between the shortfall probability of a well-diversified portfolio and an investment decision based on the expected utility maximization. As a result, an optimal portfolio is determined by either minimization of the Value-at-Risk or maximization of an expected utility.

2 - Forecasting financial market volatility using high frequency data

Panagiotis Ballis-Papanastasiou, Faculty of Economics, University of Bremen, Hochschulring 4, WiWi Gebäude, Raum 3.20, 28359, Bremen, Germany, p.papanastasiou@uni-bremen.de

We investigate whether realized volatility, realized range and implied volatility from option data have any predictive power in forecasting daily index volatility calculated by using high frequency intra day data. We examine the forecasting ability of autoregressive fractionally integrated moving average models (ARFIMA) models and Generalized AutoRegressive Conditional Heteroscedastic (GARCH) family of models on four major indexes (CAC, SP500, DAX and Dow Jones) against the random walk model, which serves as our benchmark.

3 - Forecasting commodity prices with large recurrent neural networks

Ralph Grothmann, Corporate Technology, Learning Systems (CT IC 4), Siemens AG, Otto-Hahn-Ring 6, 81735, München, Germany, ralph.grothmann@siemens.com

In the age of globalization, financial markets are highly interrelated. Usual segregated market analyses are therefore questionable. What is required is a joint modeling of all interrelated markets. To this end, we have developed large time-delay recurrent neural networks that model coherent markets as interacting dynamical systems, which has been applied successfully to forecasts in the commodity markets. Our integrated market model integrates major international stock, bond and foreign exchange markets as well as major primary energy markets.
2 - Simulation of hospital blood banks for service quality improvement

Volkan Sonmez, Department of Industrial Engineering, Hacettepe University, Hacettepe University Department of Industrial Engineering, Beytepe Ankara, 06800, Ankara, Turkey, volkansz@hacettepe.edu.tr, Murat Caner Testik, Banu Yüksel Ozkaya

Immense demand for blood products increases the importance of blood banks’ service quality. Due to the complexity of analytical models for blood donation processes, simulation modeling is an effective tool. In this study, we use simulation approach to analyze and improve Hacettepe University Hospital’s blood donation process. Our model takes into account waiting lines at various stages and capacity constraints such as the number of beds and staff. Model is used first to analyze the current system and then alternative systems are proposed to minimize waiting times and increase utilization.

3 - Empirical investigation of factors moderating it—performance relationship in developed and developing countries

Ali Asghar Anvary Rostamy, Management, Tarbiat Modares University (TMU), Department of Management, Tarbiat Modares University, Chamran Expressway-Nasr Street, Tehran, Iran, 19546, Tehran, Tehran, Iran, Islamic Republic Of, anvary@modares.ac.ir

This paper provides a new conceptual model that offering an empirically based insight into the effects of IT-Performance moderators in developed and developing countries. Using data from 34 developed and 211 developing countries and applying Pearson Correlation Method and Structured Equation Model, we found some interesting results determine moderor variables significantly moderate the IT-performance relationship in developing and developed countries, respectively. Results of this research confirm fitness of the data with our proposed new Structured Equation model.
Wednesday 09:35-11:05

WB-01

Wednesday 09:35-11:05
Beethoven

Keynote WM1

Stream: Keynote Talks
Keynote session
Chair: Endre Boros, RUTCOR, Rutgers University, 08854, Piscataway, New Jersey, United States, Endre.Boros@rutcor.rutgers.edu
Chair: Roman Slowinski, Institute of Computing Science, Poznan University of Technology, Laboratory of Intelligent Decision Support Systems, Street Piotrowo 2, 60-965, Poznan, Poland, roman.slowinski@cs.put.poznan.pl

1 - Problem solving by general purpose solvers
Toshihide Ibaraki, Informatics, Kwansei Gakuin University, 2-1 Gakuen, Sanda, Hyogo, Japan, 669-1337, Sanda, Hyogo, Japan, tibaraki@kwansei.ac.jp

To solve problems abundant in real world applications, we have been proposing an approach of using general purpose solvers, since we cannot afford to prepare special purpose algorithms for all individual problems. For this, we developed general purpose solvers for several standard problems such as CSP (constraint satisfaction problem), RCPSP (resource constrained project scheduling problem) and VRP (vehicle routing problem), among others. Their algorithms are all based on metaheuristics which utilize local search as their cores. The solvers have been successfully applied to many applications. In this talk, we report some of our recent experiences, including those for ITC2007 (International Timetabling Competition) and other industrial applications.

2 - The dominance-based rough set approach for decision analysis and operations research
Salvatore Greco, Department of Economics and Quantitative Methods, University of Catania, Corso Italia 55, 95129, Catania, Italy, salgreco@unicat.it

Rough set approach proposed by Pawlak at the beginning of eighties can be considered as a mathematical basis for reasoning about data. It has been applied in a large spectrum of domains, ranging from medicine to chemistry, and from biology to finance. Standard rough set theory is not able, however, to deal with ordinal data which are so important for decision problems where they represent preferences. On the basis of this remark, Dominance-based Rough Set Approach (DRSA) has been proposed and developed since mid-nineties. It accepts preference information in the easy form of examples of decisions, and gives as output well understandable “if …, then …” decision rules, such as “if objective_1 reaches at least value alpha_1 and objective_2 reaches at least value alpha_2 then the considered solution is good”. The simple input of decision examples and the comprehensible output in terms of decision rules makes of DRSA a decision support “glass box“, which contrasts with many existing “black boxes”. DRSA has also been successfully applied to decision under uncertainty and time preference. Moreover, DRSA has been integrated with interactive multiobjective optimization procedures, in particular, evolutionary procedures, that can be used to deal with hard operations research problems, like production planning, portfolio selection, scheduling, inventory management, and so on. We present basic ideas of DRSA with an emphasis on its applications in operations research.

WB-02

Wednesday 09:35-11:05
Schumann

Keynote WM2

Stream: Keynote Talks
Keynote session
Chair: Silvano Martello, DEIS, University of Bologna, Viale Risorgimento 2, 40136, Bologna, Italy, smartello@deis.unibo.it
Chair: Paolo Toth, DEIS, University of Bologna, Viale Risorgimento 2, 40136, Bologna, Italy, paolo.toth@unibo.it

1 - Routing in graphs with applications to material flow problems

Rolf Möhring, Institut für Mathematik, Technische Universität Berlin, Straße des 17 Juni 136, 10623, Berlin, Rolf.Moehring@TU-Berlin.DE

Material flow problems are complex logistic optimization problems. We want to utilize the available logistic network in such a way that the load is minimized or the throughput is maximized. This lecture deals with these optimization problems from the viewpoint of network flow theory and reports on two industrial applications: (1) controlling material flow with automated guided vehicles in a container terminal (cooperation with HHLA), and (2) timetabling in public transport (cooperation with Deutsche Bahn and Berlin Public Transport). The key ingredient for (1) is a very fast real-time algorithm which avoids collisions, deadlocks, and other conflicts already at route computation, while for (2) it is the use of integer programs based on special bases of the cycle space of the routing graph.


2 - 2-dimensional packing problems in telecommunications

Andrea Lodi, D.E.I.S., University of Bologna, Viale Risorgimento 2, 40136, Bologna, Italy, andrea.lodi@unibo.it

We consider 2-dimensional packing problems arising from telecommunications applications. In particular, according to WiMAX technology, information is sent to several users within the same frame, and an efficient and fast way to send information and to recover it is required. This leads to interesting 2-dimensional packing problems for which different objective functions can be defined. For a simplified version of the real-world problem we provide an approximation algorithm and different fast heuristics, which turn out to be effective in practice. Finally, computational experiments on a set of real-world instances are presented.
**Wednesday 09:35-11:05**

**Reger**

**Keynote WM3**

Stream: Keynote Talks

**Keynote session**

Chair: Gerhard-Wilhelm Weber, Institute of Applied Mathematics, Middle East Technical University, ODTÜ, 06531, Ankara, Turkey, gweber@metu.edu.tr

1 - Optimal control of manufacturing systems: solution of fluid approximation and tracking by queueing model.

Gideon Weiss, Department of Statistics, The University of Haifa, 31905, Haifa, Israel, gweiss@stat.haifa.ac.il

We consider the optimal control of a large manufacturing system, over a finite time horizon, e.g. a semiconductor wafer fabrication plant.

We model this as a multi-class queueing network. We approximate the queueing network by a fluid network, and obtain an optimal fluid solution by solving a separated continuous linear program (SCLP).

To track this fluid solution we model the deviations of the real system from the fluid solution by a multi-class queueing network with infinite virtual queues (IVQ). By keeping these deviations stable we obtain an asymptotically optimal control policy.

We shall explain our motivation and the main features of this approach. We will then introduce the two themes of which it is based: A novel simplex like algorithm for the solution of SCLP, and the modeling device of IVQs.

While this talk combines ideas from Manufacturing, Optimization and Queueing, it will be accessible to a wide audience of EURO members.

2 - Semi-infinite optimization

Hubertus Th. Jongen, Dept. Mathematics, RWTH Aachen University, Templergraben 55, 52062, Aachen, Germany, jongen@rwth-aachen.de

Semi-infinite optimization problems (SIP) are problems in finite dimensions with an infinite number of inequality constraints. For example, the index set of inequality constraints might be an interval, a rectangle or a compact manifold with boundary. In case that the latter index set also depends on the state variable, SIP is called a general(ized) semi-infinite optimization problem (GSIP). The structure of GSIP is much more complicated. In this lecture we present a survey on structural results on SIP and GSIP.

**Wednesday 11:20-12:40**

**Beethoven**

**Recent advances in combinatorial optimization II**

Stream: Combinatorial Optimization

**Invited session**

Chair: Andrea Lodi, D.E.I.S., University of Bologna, Viale Risorgimento 2, 40136, Bologna, Italy, andrea.lodi@unibo.it

Chair: Michele Monaci, D.E.I., University of Padova, Via Gradenigo 6/A, 35131, Padova, Italy, monaci@dei.unipd.it

1 - Intersection cuts revisited

Egon Balas, Tepper School of Business, Carnegie Mellon University, 15213, Pittsburgh, PA, United States, eb17@andrew.cmu.edu

Intersection cuts from maximal lattice-free convex sets have recently been investigated to derive cutting planes simultaneously from multiple rows of a simplex tableau. We examine the relationship of these cuts to disjunctive cuts and lift-and-project cuts from multiple-term disjunctions. In the case of 0-1 mixed-integer programs (MIPs), cuts from maximal q-dimensional lattice-free convex sets are dominated by cuts from q-term disjunctions, which in turn are rank q split cuts. For a general MIP, we examine the relation between disjunctive hulls, corner polyhedra and the integer hull.

2 - A polyhedral approach to the single-row facility layout problem

Adam Letchford, Department of Management Science, Lancaster University, Management School, LA1 4YX, Lancaster, United Kingdom, A.N.Letchford@lancaster.ac.uk, Andre Amaral

The Single Row Facility Layout Problem is the NP-hard problem of arranging facilities of given lengths on a line, while minimizing a weighted sum of the distances between all pairs of facilities. We perform the first ever polyhedral study of this problem. We derive several classes of facet-inducing inequalities, and also point out a connection to the so-called cut cone. We also describe a cutting plane algorithm and present computational results. Finally, we discuss how to adapt the approach to other layout problems.

3 - A branch-and-bound algorithm for the multi-type capacitated facility location problem

Andreas Klose, Department of Mathematical Sciences, University of Aarhus, Ny Munkegade, Building 1530, 8000, Aarhus, Denmark, aklose@imf.au.dk

The multi-type capacitated facility location problem (MCFLP) is to locate a set of facilities and to allocate capacity and customer demands to them, so as to minimize fixed facility, capacity acquisition as well as variable supply costs. We present a branch-and-bound algorithm that is based on Lagrangian relaxation of demand constraints and subgradient optimization. Lagrangean solutions are averaged for primal solution recovery and branching decisions are based on the estimated primal solution to the Lagrangean dual. First computational experiences are reported.
In the maritime liner business, several vessels are deployed on a route in order to meet calling frequency expectations. First, the combination of vessels and transshipment points used by the carrier is of no concern to the customer. Second, there exist multiple fleet configurations that could provide a given level of service, but a regularity requirement likely increases fleet operating expenses. We present a model for fleet configuration with and without calling regularity. We use simulation to assess the level of service and robustness of the two alternative designs.

2 - A heuristic for maritime inventory routing

Oddvar Kloster, SINTEF ICT, Postboks 124 Blindern, 0314, OSLO, Norway, okl@sintef.no, Truls Flatberg

In maritime inventory routing, a fleet of vessels is employed to transport products that are produced and consumed in different ports, in order to keep stock levels in each port legal. In addition, regular bookings/orders may be transported. We describe construction and optimization heuristics that can solve a wide range of problem variants, including pure inventory, pure tramp, mixed, shipping and resolution of the NEARP, and network based heuristics for aggregating node-based demand into demands on arcs and edges. The results are competitive in cases where a MIP solver is available for comparison.

3 - The node edge arc routing problem - applications and heuristics

Geir Hasle, Applied Mathematics, SINTEF ICT, P.O. Box 124 Blindern, NO-0314, Oslo, Norway, Geir.Hasle@sintef.no, Truls Flatberg, Oddvar Kloster, Eivind Nilsen, Morten Smedsrud

In the VRP literature, the Arc Routing Problem is often advocated as an adequate model for routing applications such as newspaper delivery and garbage collection. We argue that a better model is the Node Edge Arc Routing Problem (NEARP), combining demand on nodes, edges, and arcs in a transportation network. We describe how we have extended a node based VRP solver to enable modeling and resolution of the NEARP and network based heuristics for aggregating node-based demand into demands on arcs and edges.

Experimental results on standard benchmarks and industrial cases are presented.
Job-Shop Scheduling

Stream: Scheduling

Invited session

Chair: Kun Yuan, LGIPM / COSTEAM, Universite Paul Verlaine - Metz/INRIA Nancy grand est, Ile du Saulcy, UFR MIM, 57045, Metz, France, yuankun_hust@hotmail.fr

1 - The flexible blocking job shop with transfer and setup times

Heinz Gröflin, Dept. of Informatics, University of Fribourg, Bd de Pérolles 90, 1700, Fribourg, Switzerland, heinz.groeflin@unifr.ch, Reinhard Bürgy

We consider a job shop (FBJS) with flexible machines and blocking (a job, after completing an operation, waits on the machine until its next operation starts). Transfer times, passing a job from a machine to the next, and setup times are allowed. The goal is to assign machines and schedule operations, minimizing makespan. A tabu search is proposed based on a disjunctive graph framework of job insertion with local flexibility. Feasible neighbors are generated, moving an operation together with implied moves. Extensive numerical results validate the method and establish benchmarks for the FBJS.

2 - The job-shop scheduling problem with shift-varying production time

Christian Rathjen, Economics, University of Wuppertal, Gaußstraße 20, building M, room 12.34, 42119, Wuppertal, Germany, crathjen@winfor.de, Stefan Bock, Simon Goetz

In industries there shift working often takes place and within different working shifts setup times and production times can vary because of shift-based resource capacities. A mathematical formulation of the job-shop scheduling problem with different production and setup times will be presented. A starting heuristic and an improvement method for this problem will be introduced and it will be demonstrated how these heuristics can be adopted to objective functions with practical relevance, such as makespan minimization and the weighted tardiness objective.

3 - A multi-agent learning approach for the job shop scheduling problem

Yailen Martinez, VUB, Pleinlaan 2, 1050, Brussels, yailenn@gmail.com, Ann Nowe

In this paper, a Multi-Agent learning approach for the JSSP is proposed, a Q-Learning algorithm is implemented assigning an agent per machine, which will decide which job will be processed next out of a set of currently waiting jobs at the corresponding resource. The behavior of the algorithm is studied using three different cost functions, and on different benchmarks problems from the OR-Library. The approach is compared with other heuristic approaches such as ACO. The results show that our approach yields solutions as good as better than the ACO approach.

4 - A mixed-integer linear programming model and a lower bound for hybrid flow shop scheduling problems with special blocking

Kun Yuan, LGIPM / COSTEAM, Universite Paul Verlaine - Metz/INRIA Nancy grand est, Ile du Saulcy, UFR MIM, 57045, Metz, France,

In this work, we consider scheduling problem of hybrid flowshops composed of identical parallel machines at each stage. The objective is the minimisation of the makespan. Contrarily to classical blocking, where the machine remains blocked until the job starts on the next machine in the routing, we consider special blocking which exists in certain industrial situations like waste treatment plants or aeronautics parts fabrications. In this case, the machine stays blocked until one job has finished its operation on the next machine. We present an MILP and a lower bound to solve this problem.

Scheduling Heuristics

Stream: Scheduling

Invited session

Chair: Prabha Sharma, Mathematics and Statistics, Indian Institute of Technology, Kanpur, Dept. of Mathematics and Statistics, I. I. T. Kanpur, 208016, Kanpur, U. P., prabha@iitk.ac.in

1 - Comparison of meta-heuristics for the single machine scheduling problem

Veronique Sels, Faculty of Economics and Business Administration, Ghent University, Faculteit Economie en Bedrijfskunde, Tweekerkenstraat 2, 9000, Gent, Oost Vlaanderen, Belgium, veronique.sels@ugent.be, Mario Vanhoucke

We consider the problem of scheduling n jobs with release times and due dates, on a single machine with the objective of minimizing the maximum lateness. This problem often occurs as a subproblem in solving more complex scheduling environments such as flowshops or job shops. We developed various meta-heuristics and compared their performance on diverse datasets. Computational results revealed that there exist problem instances where some heuristics are dominated by others. We extended our study to other similar single machine-scheduling problems with promising results.

2 - A flexible multi-objective scheduling system based on configurable heuristics

Jorge Pinho de Sousa, INESC Porto / FEUP, Campus da FEUP, Rua Dr. Roberto Frias, 4200-465, Porto, Portugal, jsousa@inescporto.pt, Luis Guardao

In this work we present a flexible, multi-objective scheduling system to tackle extensions of the classic job-shop problem. For this purpose, a simple general framework has been developed. First jobs are sequenced by hybrid constructive heuristics. Then a scheduling algorithm creates a plan for the operations. A kind of randomized local search procedure is then used to improve the job sequences. The algorithm was embedded in a DDS constructed around a powerful, interactive Gantt chart. Computational results obtained for real complex applications are very promising.

3 - A hybrid metaheuristic for machine scheduling in cell formation problems

Grammatoula Papaioannou, The Business School, Loughborough University, Ashby Road, LE11 3TU, Loughborough, United Kingdom, g.papaioannou@lboro.ac.uk, John Wilson

In this work, we consider scheduling problem of hybrid flowshops composed of identical parallel machines at each stage. The objective is the minimisation of the makespan. Contrarily to classical blocking, where the machine remains blocked until the job starts on the next machine in the routing, we consider special blocking which exists in certain industrial situations like waste treatment plants or aeronautics parts fabrications. In this case, the machine stays blocked until one job has finished its operation on the next machine. We present an MILP and a lower bound to solve this problem.
The paper describes an IP model for the cell formation problem with part-machine assignment and cell formation addressed simultaneously and part machine operation sequence taken into account. Due to the NP-hard nature of the problem a three stage heuristic approach is first proposed to generate an initial solution which is fed into a hybrid metaheuristic. The hybrid metaheuristic involves a tabu search approach and a greedy heuristic algorithm. Simulations verified the robustness of the proposed algorithm, and its effectiveness for large scale data sets.

**WC-06**

Wednesday 11:20-12:40

**Koch**

**GOR Dissertation Awards**

Stream: GOR-Awards

Invited session

Chair: **Stefan Nickel**, Institut fuer Operations Research, Universitaet Karlsruhe, Geb 11.40, 76128, Karlsruhe, Baden-Wuerttemberg, Germany, Stefan.Nickel@kit.edu

Chair: **Uwe T. Zimmermann**, Institute of Mathematical Optimization, TU Braunschweig, Pockelstrasse 14, 38106, Braunschweig, Germany, u.zimmermann@tu-bs.de

1 - Extending concepts of reliability

**Sebastian Stiller**, Institut für Mathematik, Technische Universität Berlin, 10623, Berlin, Berlin, Germany, stiller@math.tu-berlin.de

Recoverable robustness combines the virtues of classical robust optimization and stochastic programming. A solution is recovery robust, if it can be recovered by a limited effort in every likely scenario. We develop the theory and efficient algorithms for the case of linear recovery. We device the first, best possible, constant factor approximate feasibility test for arbitrary multiprocessor sporadic real-time scheduling instances. We give the first non-trivial analysis of a network creation game with exponential payoff function. We determine its Price of Anarchy exactly.

2 - Waiting time and product age distribution of a (r,s)-inventory policy.

**Lars Fischer**, Department of Supply Chain Management and Production, University of Cologne, Albertus-Magnus-Platz, 50859, Cologne, Germany, euro-online.uni@larsfischer.de

We analyse a (r,S)-inventory policy under stochastic demand. Two customer oriented service criteria are considered: First the probability distribution of the waiting time which is important from the perspective of the customer since his contentment depends on the time until his order is filled. Second the probability distribution of the product age which is relevant for perishable goods, e.g. food or medicine, where product age dependent costs affect the optimality of inventory policy. We consider both periodic and sporadic demand with arbitrarily distributed times between orders (compound demand).

3 - Neural networks for simultaneous forecasting and inventory level estimation - an experimental evaluation on synthetic and empirical retail time series

**Sven F. Crone**, Department of Management Science, Lancaster University Management School, Bailrigg Campus, LA1 4YX, Lancaster, United Kingdom, s.crone@lancaster.ac.uk

In forecasting for inventory management, neural networks (NN) are conventionally parameterised using squared error loss criteria. This thesis extends NNs to the use of arbitrary objective functions of decision costs. Using asymmetric costs of over- and under-forecasting, NNs are expanded beyond conventional point predictions towards a direct estimation of cost minimal inventory levels. The accuracy of NN in forecasting and inventory performance is evaluated in a representative evaluation across multiple synthetic and empirical retail time series in comparison to statistical benchmark methods.

**WC-07**

Wednesday 11:20-12:40

**GSI - S 29**

**Transit network design problems with elastic demand**

Stream: Optimization in Public Transport

Invited session

Chair: **Mariano Gallo**, Dipartimento di Ingegneria, Università degli Studi del Sannio, Piazza Roma 21, 82100, Benevento, Italy, gallo@unisannio.it

1 - The transit network design problem with elastic demand and internalisation of external costs

**Mariano Gallo**, Dipartimento di Ingegneria, Università degli Studi del Sannio, Piazza Roma 21, 82100, Benevento, Italy, gallo@unisannio.it, **Bruno Montella**, **Luca D'Acquino**

In this paper we study the transit network design problem with elastic demand. We propose a multimodal optimisation model that considers an objective function equal to the sum of (car and transit) user costs, firm costs, external costs (air pollution, noise, etc.) and other social costs. In the proposed model external costs are considered in the objective function and optimised taking into account the effects of improving the LOS of transit system on modal share and, therefore, on the external costs. The proposed model is tested for optimising the services on a Regional Metro System.

2 - A bus network design procedure with elastic demand

**Ernesto Cipriani**, Dept. Civil Engineering, University of Roma TRE, Via Vito Volterra 62, 00146, Roma, Italy, ecipriani@uniroma3.it, **Stefano Gori**, **Marco Petrelli**
The paper deals with the transit network design problem that is formulated as an optimization problem consisting in the minimization of all resources and costs related to the transport system, subject to bus capacity constraints and a set of feasibility constraints on route length and line frequency. The new procedure solves the transit network design problem in a multimodal, demand elastic urban context, explicitly taking into consideration the relationships among modal split, level of transit services and externalities.

3 - A heuristic algorithm for optimizing frequencies in a transit network

Eusebio Angulo Sánchez-Herrera, Mathematics, Escuela Superior de Informática, Universidad de Castilla La Mancha, Paseo de la Universidad, 4, 13071, Ciudad Real, Castilla La Mancha, Spain, Eusebio.Angulo@uclm.es, Ricardo García

This paper dealt with the problem of optimizing frequencies in a transit network in a context of medium-term planning. It is assumed that the size of the fleet can be a variable and requires to be decided. The model is formulated as a bi-level optimization problem. An heuristic algorithm for the integer bilevel model has been proposed. It is based on the optimality conditions of Karush-Kuhn-Tucker (KKT). A computational experience on the rapid transit network of Seville has been carried out. The convergence of the algorithm is shown in the numerical tests.

4 - The route deviation bus model compared to a real low transit demand service management

Antonio Pratelli, Dept. of Civil Engineering, University of Pisa, Largo Lazzarino 1 (ex Via Diotisalvi 2), 56126, Pisa, Italy, antonio.pratelli@ing.unipi.it

We present the design analysis performed on a real network through a new model for the bus deviation route problem, or RDBP, which is based on mixed integer linear programming. The study network is placed in Campi Bisenzio, a small town close to Florence. This urban area is characterized by a low level of the transit demand during the major part of a day. First, the RDB problem is briefly summarized. Second, the results drawn from the model application to the major part of a day. First, the RDB problem is briefly summarized. Second, the results drawn from the model application to the existing in Campi Bisenzio instance are shown in comparison with the exist-

We model budgeted services with permanent and contingent capacity costs. We consider a stochastic demand of tasks to be performed. No backordering of tasks is allowed, capacity shortages are penalized in each week. We optimize the permanent capacity at the start of the year and the contingent capacity based on the weekly demand, several models are developed, with hard and soft budget constraints, and different capacity shortage penalty cost functions. We provide analytical results and perform numerical experiments, showing among others the optimal budget spending patterns.

2 - On the optimal product assortment

Simme Douwe Flapper, Technische Universiteit Eindhoven, Netherlands, s.d.p.flapper@tm.tue.nl

Which products should be in the product assortment/portfolio of a company if part or all of the (potential) customers only order if the company can deliver timely all desired quantities for all products the customer is interested in (one-stop-shopping concept)? Mathematical models to calculate the consequences of using two of the most often used strategies (product based vs. customer based) are given for a producer confronted with limited capacity, setup times and setup cost. The results for a case study in practice are presented, as well as suggestions for further research.

3 - The contract manufacturer’s portfolio management - optimal allocation of production flexibility

Youssef Boulaksil, School of Industrial Engineering, Eindhoven University of Technology, PAV E16, P.O. Box 513, 5600MB, Eindhoven, Netherlands, Y.Boulaksil@tue.nl, Martin Grunow, Jan C. Fransoo

We consider a contract manufacturer who serves a number of outsourcing (customers) on the same capacitated production line. The outsourcing have different risk profiles and the contract manufacturer faces the question of how to optimize its portfolio, i.e. how to allocate the production flexibility in an optimal way. We develop a mathematical programming model and perform a simulation study by solving the model in a rolling horizon setting. The simulation results reveal interesting managerial insights, which are helpful for managers when having negotiations with the outsourcing companies.

WC-08
Wednesday 11:20-12:40
GS1 - S 30

Capacity Planning
Stream: Supply Chain Management
Invited session
Chair: Youssef Boulaksil, School of Industrial Engineering, Eindhoven University of Technology, PAV E16, P.O. Box 513, 5600MB, Eindhoven, Netherlands, Y.Boulaksil@tue.nl

1 - Permanent and contingent workforce budgeting under stochastic demand

Nico Dellaert, IE&IS, Technische Universiteit Eindhoven, Postbus 513, 5600MB, Eindhoven, n.p.dellaert@tue.nl, Jolly Jeunet

We consider a stochastic demand of tasks to be performed. No backordering of tasks is allowed, capacity shortages are penalized in each week. We optimize the permanent capacity at the start of the year and the contingent capacity based on the weekly demand, several models are developed, with hard and soft budget constraints, and different capacity shortage penalty cost functions. We provide analytical results and perform numerical experiments, showing among others the optimal budget spending patterns.

WC-09
Wednesday 11:20-12:40
GS1 - S 5

Rostering in the Services Industry
Stream: Timetabling and Rostering
Invited session
Chair: Jonas Bæklund, Department of Mathematical Sciences, Aarhus University, Ny Munkegade 118, 8000, Aarhus, Denmark, baeklund@imf.au.dk

1 - A solution for workforce supply chain management in an outsourcing environment

Changrui Ren, IBM China Research Lab, Building 19 Zhongguancun Software Park, 8 Dongbeiwang WestRoad, Haidian District, 100193, Beijing, renr@cn.ibm.com

Workforce is crucial to the success of service industry, especially for those software and consulting firms, where much of their revenue comes from the assignment of highly-skilled professionals. This is even more critical in the outsourcing environment, under which some of the professionals are outsourced from external vendors. This paper studies on how to hire/assign right people at the right time for the right project with the right cost in the outsourcing environment. Based on the concept of “workforce supply chain”, the demand and supply matching problem is mainly discussed.
problem. An overview of different recent solution methods suggested for this problem includes constraint programming (CP), mixed integer linear programming (MILP), and heuristics for nurse rostering. This paper presents a PCSP model for the nurse rostering problem, which is a constraint satisfaction problem and objective function. The search for solution can be guided by a value ordering heuristic that attempts to minimize the number of violations after each step.

4 - Nurse rostering - an overview.
Jonas Baeklund, Department of Mathematical Sciences, Aarhus University, Ny Munkegade 118, 8000, Aarhus, Denmark, baeklund@imf.au.dk

Nurse rostering is a complex scheduling problem, occurring every month in every hospital around the world. Efficient solution methods, that create good solutions are required, since schedules impact the quality of health care, the requirement of nurses, and the hospitals' budgets. Solutions methods range from ILP models, constraint satisfaction, Lagrangean relaxation and column generation to manual scheduling as well as heuristics of all kind. This paper presents an overview of different recent solutions methods suggested for this problem.

We formulate an interior point algorithm without "apriori" scalarization based on gradient-like directions to solve a box-constrained multiobjective optimization problem. We prove the convergence of the algorithm to the critical points of the considered problem, where the classical Kuhn-Tucker first order optimality conditions for multi-objective box-constrained problem are satisfied. A numerical validation of the algorithm is carried out through direct calculations on test functions proposed in the literature.

2 - The geometry of strict maximality
Enrico Miglierina, Dipartimento di Economia, Università dell’Insubria, via Monte Generoso 71, 21100, Varese, Italy, enrico.miglierina@uninsubria.it, Emanuele Casini

The notion of strictly maximal point is a solution concept that plays an important role in the study of the stability and well-posedness of vector optimization problems. We study some geometrical aspects of this notion. More precisely we individuate some relationships between strict maximality and the properties of the bases of the ordering cone. In order to prove this result a new characterization of the existence of a bounded base for a closed convex cone is given. Moreover we link strict maximality to the geometrical notion of strongly exposed points of a given set.

3 - On continuity properties in vector optimization
Ruben Lopez, Departamento de Matematica y Fisica Aplicadas (DMFA), Universidad Catolica de la Santisima Concepcion, Alonso Ribera 2850, 409-0541, Concepcion, VIII Region, Chile, rlopez@uscd.cl, Cesar Gutierrez, Vicente Novo

In this work, we study continuity properties of various mappings that appear when dealing with vector optimization problems. To do this end we employ a new type of convergence for vector valued mappings.

* This work has been supported by Proyecto FONDECYT de Investigación 11060015 through CONICYT-Chile.

4 - On the characterization of approximate efficiency in vector optimization via approximate solutions of some scalarized problems
Cesar Gutierrez, Departamento de Matematica Aplicada, Universidad de Valladolid, E.T.S.I. Informatica, C6, Cementerio s/n, Campus Miguel Delibes, 47011, Valladolid, Spain, cesargv@mat.uva.es, Bienvenido Jimenez, Vicente Novo

This talk concerns with the characterization of approximate solutions of vector optimization problems via scalarization processes. Two properties on the sublevel sets at zero of the scalarization mapping are introduced, from which necessary and sufficient optimality conditions for approximate efficient solutions are deduced through approximate solutions of the scalarized problem. By these properties one can easily propose scalarization processes to solve approximately a vector optimization problem through scalar optimization problems. Some examples are showed that illustrate this approach.

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**WB-10**
Wednesday 11:20-12:40
GSI - S 6

**Vector and Set-Valued Optimization II**

Stream: Vector and Set-Valued Optimization

*Invited session*

Chair: César Gutiérrez, Departamento de Matemática Aplicada, Universidad de Valladolid, E.T.S.I. Informática, C6, Cementerio s/n, Campus Miguel Delibes, 47011, Valladolid, Spain, cesargv@mat.uva.es

1 - Box constrained multi-objective optimization: a gradient-like method without "a priori" scalarization

Elena Molho, Dipartimento di Economia Politica e Metodi Quantitativi, Università di Pavia, Via San Felice 5, 27100, Pavia, Italy, molho@eco.unipv.it, Enrico Miglierina, Maria Cristina Recchioni

We formulate an interior point algorithm without “apriori” scalarization based on gradient-like directions to solve a box-constrained multiobjective optimization problem. We prove the convergence of the algorithm to the critical points of the considered problem, where the classical Kuhn-Tucker first order optimality conditions for the multi-objective box-constrained problem are satisfied. A numerical validation of the algorithm is carried out through direct calculations on test functions proposed in the literature.

2 - The geometry of strict maximality

Enrico Miglierina, Dipartimento di Economia, Università dell’Insubria, via Monte Generoso 71, 21100, Varese, Italy, enrico.miglierina@uninsubria.it, Emanuele Casini

The notion of strictly maximal point is a solution concept that plays an important role in the study of the stability and well-posedness of vector optimization problems. We study some geometrical aspects of this notion. More precisely we individuate some relationships between strict maximality and the properties of the bases of the ordering cone. In order to prove this result a new characterization of the existence of a bounded base for a closed convex cone is given. Moreover we link strict maximality to the geometrical notion of strongly exposed points of a given set.

3 - On continuity properties in vector optimization

Ruben Lopez, Departamento de Matematica y Fisica Aplicadas (DMFA), Universidad Catolica de la Santisima Concepcion, Alonso Ribera 2850, 409-0541, Concepcion, VIII Region, Chile, rlopez@uscd.cl, Cesar Gutierrez, Vicente Novo

In this work, we study continuity properties of various mappings that appear when dealing with vector optimization problems. To do this end we employ a new type of convergence for vector valued mappings.

* This work has been supported by Proyecto FONDECYT de Investigación 11060015 through CONICYT-Chile.

4 - On the characterization of approximate efficiency in vector optimization via approximate solutions of some scalarized problems

Cesar Gutierrez, Departamento de Matematica Aplicada, Universidad de Valladolid, E.T.S.I. Informatica, C6, Cementerio s/n, Campus Miguel Delibes, 47011, Valladolid, Spain, cesargv@mat.uva.es, Bienvenido Jimenez, Vicente Novo

This talk concerns with the characterization of approximate solutions of vector optimization problems via scalarization processes. Two properties on the sublevel sets at zero of the scalarization mapping are introduced, from which necessary and sufficient optimality conditions for approximate efficient solutions are deduced through approximate solutions of the scalarized problem. By these properties one can easily propose scalarization processes to solve approximately a vector optimization problem through scalar optimization problems. Some examples are showed that illustrate this approach.

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**WC-11**
Wednesday 11:20-12:40
GSI - S 17

**Robust ordinal regression**

Stream: Multiple Criteria Decision Analysis

*Invited session*

Chair: Salvatore Greco, Department of Economics and Quantitative Methods, University of Catania, Corso Italia 55, 95129, Catania, Italy, salgreco@unicat.it
1 - The most representative value function in robust multiple criteria sorting
Salvatore Greco, Department of Economics and Quantitative Methods, University of Catania, Corso Italia 55, 95129, Catania, Italy, salgreco@unict.it, Milosz Kadziński, Roman Slowinski

Recently a method based on robust ordinal regression, UTADIS-GMS, has been proposed to deal with multiple criteria sorting. It considers the whole set of value functions coupled with a set of thresholds representing exemplary assignments given by the DM. Application of UTADISGMS results in a necessary and a possible sorting. In order to ease interpretation of these results, we propose a methodology permitting to build the most representative value function taking into account the necessary and possible sortings.

2 - Non-additive robust ordinal regression with choquet integral
Benedetto Matarazzo, Department of Economics and Quantitative Methods, Faculty of Economics - University of Catania, Corso Italia 55, 95129, Catania, Italy, matarazz@unict.it, Silvia Angelilla, Salvatore Greco

In this presentation, we want to give the basis of a general methodology for non-additive robust ordinal regression, for Choquet integral and its generalizations (therefore also the bipolar Choquet integral) in the whole spectrum of decision problems, i.e. not only ranking and choice, but also multicriteria classification. The proposed non-additive robust ordinal regression takes inspiration from the robust ordinal regression, recently proposed in the multicriteria methodologies UTAGMS, GRIP and UTADISGMS.

3 - The possible and necessary approach for robustness analysis in decision aid and operations research
Vincent Mousseau, LGI, Ecole Centrale Paris, Grande voie des vignes, 92 295, Chatenay Malabry, France, vincent.mousseau@ecp.fr, Salvatore Greco, Roman Slowinski

To deal with robustness concerns, we consider decision problems in terms of a set of possible worlds (scenarios). Each possible world is characterized by a specific instantiation of data used for problem formulation and by a preference relation on the space of the objective values. An alternative is necessarily preferred to another if it is preferred in at least one possible world. Credibility degree of possible worlds can be considered in this context. We illustrate these concepts on a multiobjective knapsack problem.

In this talk we present some results concerning the study of two most widely used decomposition-coordination approaches based on either the generation of feasible or non-feasible points respectively. For finding proper values of coordination parameters some rapidly convergent iterative methods are develope if the feasible approach is used. For the non-feasible approach a few gradient-type methods are studied.

2 - Multiobjective decomposition of positive integer matrix: application to radiotherapy
Thibaut Lust, Laboratory of Mathematics and Operational Research, Faculté Polytechnique de Mons, 9, rue de Houdain, 7000, Mons, Belgium, thibaut.lust@fpm.ac.be, Jacques Teghem

We consider the following problem: to decompose a positive integer matrix into a linear combination of binary matrices that respect the consecutive ones property. This problem occurs in intensity-modulated radiotherapy treatment. The aim is to find a decomposition that minimizes the irradiation time, and the setup-time to configure a multi-leaf collimator at each step of the decomposition. We propose for this NP-hard multiobjective problem a heuristic method, based on the Pareto local search method. Experiments are carried out on different size instances and the results are reported.

3 - Modifying roc curve for diagnostic systems with more than two classes
Kasirga Yildirak, IAM, METU, 06531, Ankara, Turkey, kasirga@metu.edu.tr, Efsun Kürtün, Gerhard-Wilhelm Weber

In diagnostic tests, to classify a population into more than two classes is also very important. As ROC curve analysis is weak in validation of the systems with more than two classes, it needs improvement. We optimize the ROC curve as an objective on discrimination power and introduce constraints preventing the length for each class from becoming too small. We combine both aims in a multiobjective program, and treat a resulting regression problem by Levenberg-Marquardt method and special techniques. Various applications in medicine and finance are discussed, and a conclusion is given.

WC-13
Wednesday 11:20-12:40
GSI - S 31
Competitive location 1
Stream: Location Analysis
Invited session
Chair: Blas Pelegrin, Statistics and Operations Research, University of Murcia, Spain, pelegrin@um.es

1 - A discrete competitive facility location model with variable attractiveness
Hande Kucukaydin, Industrial Engineering, Bogazici University, Bogazici University Industrial Engineering Department, Bebek-Istanbul-Turkey, 34342, Istanbul, Turkey, hande.kucukaydin@boun.edu.tr, Necati Aras, I. Kuban Altinel

We consider the discrete version of the competitive facility location problem in which new facilities have to be located by a new market entrant firm to compete against already existing ones that may belong to one or more competitors. The objective of the firm is to determine the locations of the new facilities and their attractiveness levels to maximize the profit. We formulate a mixed-integer nonlinear programming model for this problem and propose three methods for its solution: a Lagrangean heuristic, two branch-and-bound methods using Lagrangean and nonlinear programming relaxations.
We consider a periodic review inventory system with supply reliability and demand cancellation issues. The optimal inventory policy is dependent on the supply reliability and cancellation behavior of the customer. We also investigate the impact of supply uncertainty and demand cancellation on the performance of the supply chain. We develop a model to quantify the importance of encouraging low cancellation behavior and reducing variability supply reliability. The single and multiple periods are studied. Finally, we show that an order-up-to policy is optimal.

2 - Investigating advantages of advanced demand information under heterogeneous demand

Bisheng Du, Department of Business Studies, Aarhus School of Business, University of Aarhus, Fuglesangs Alle 4, DK-8210 Aarhus V, 8210, Aarhus V, Aarhus, Denmark, bisd@asb.dk, Christian Larsen

We study an inventory system operated by a base stock policy. There are two customer classes that must be served. One customer class, Class 1, does not provide any advanced demand information at all, while the other, Class 2 does. Using the service measures, order fill rate and volume fill rate, we will investigate the magnitude of discrepancy in service between these two customer classes, as well as identifying the cases where customer Class 2 is rewarded by their advanced demand information, by having the best service among the two classes.

3 - Modeling and managing the variability in supply chains with the peakedness

Ying Wei, Universite catholique de Louvain, CORE, Voie du Roman Pays 34, 1348, Louvain-la-Neuve, Belgium, ying.wei@uclouvain.be, Philippe Chevalier, Jean-François Macq, Jean-Christophe Van den Schrieck

We introduce a novel way to measure the variability of flows in supply chains with the peakedness. We are able to estimate the peakedness from individual as well as batch arrival data. We can also characterize demand, forecast and inventory variables based on the peakedness functional. Our results hold for single stage inventory system, multistage inventory system, and a tree-structured supply chain with single supplier and multiple retailers. Furthermore, the peakedness can be applied to study traditional inventory models such as quantifying bullwhip effects, and inventory pooling effects.
We present a situation in which the standard approach to proving the NP-hardness of optimization problems fails to work due to the NP-hardness of computing objective function values of a scheduling problem under study. For a special case of this problem, we establish that constructing an optimal schedule takes polynomial time while computing the objective function value is NP-hard. We provide a new approach to proving the NP-hardness of optimization problems without the need to compute the objective function values, and use this approach to prove the NP-hardness of the problem under study.

2 - An improved heuristic algorithm for the set covering problem

Tsahi Avrahami, Hativat Alexandroni 7/44, 47307, Ramat-Hasharon, tsahiavr@zahav.net.il, Amnon Gonen

The set covering problem is well known as an NP-complete problem. A common heuristic family of algorithms that solves the problem is the Greedy type algorithms. In this study we have to cover N sites by allocating minimum number of servers. The study compares the Improved Heuristic Algorithm (IHA) with the Greedy one. The results showed that in most cases, for symmetric servers, the IHA finds a better solution. For big problems of above 600 sites, the probability to find a better solution is above 80%. However, the computing time of the IHA is much higher than the greedy one.

3 - Testing membership in the 0, 1/2-closure is strongly NP-hard, even for polytopes contained in the n-dimensional 0/1-cube

Sebastian Pokutta, Department of Mathematics, Technical University of Darmstadt, Alois-Eckert-Str. 4, 60528, Frankfurt, Germany, sebastian.pokutta@mac.com, Adam Letchford, Andreas S. Schulz

Caprara and Fischetti introduced a class of cutting planes, called 0,1/2-cuts, which are valid for arbitrary integer linear programs. They also showed that the associated separation problem is strongly NP-hard. We show that separation remains strongly NP-hard, even when all integer variables are binary, even when the integer linear program is a set packing problem, and even when the matrix of left-hand side coefficients is the clique matrix of a graph containing a small number of maximal cliques. In fact, we show these results for the membership problem, which is weaker than separation.

2 - Learning of label ordering for ordered and non-ordered classification

Philippe Fortemps, MathRO, Faculty of Engineering, Mons, Belgium, Rue de Houdain, 9, 7000, Mons, Belgium, philippe.fortemps@fpmu.ac.be, Salvatore Greco, Roman Slowinski

Label ordering is a frequently considered classification problem where for each object characterized by multiple attributes, one is looking for an order of class labels according to decreasing credibility of assignment. The order of labels can be partial or total. The core of proposed methodology is based on conversion of ordered or non-ordered classification problems into a formulation which can be handled by the Dominance-based Rough Set Approach (DRSA). Our approach considers also the possibility of monotonicity constraints between attribute values and class labels.

3 - Multi-criteria ranking using dominance-based rough set approach

Marcin Szelag, Institute of Computing Science, Poznan University of Technology, ul. Piotrowo 2, 60-965, Poznan, Poland, marcin.szelag@cs.put.poznan.pl, Roman Slowinski, Salvatore Greco

We apply the Dominance-based Rough Set Approach to the multi-criteria ranking problem. First, the decision maker compares pairwise some alternatives. Then, we calculate rough approximations of preference relations. These approximations are the basis for induction of decision rules, which imply a preference graph in the complete set of alternatives. Finally, this graph is exploited using a ranking procedure. As it is known, no procedure satisfies all desirable properties. Therefore, we identify procedures non-dominated with respect to a core of desirable properties.

4 - Preference learning in interactive multiobjective optimization

Roman Slowinski, Institute of Computing Science, Poznan University of Technology, Laboratory of Intelligent Decision Support Systems, Street Piotrowo 2, 60-965, Poznan, Poland, roman.slowinski@cs.put.poznan.pl, Salvatore Greco, Benedetto Matarazzo

We present three cases of preference learning in interactive multiobjective optimization (MOO). In all cases, the DM is just asked to indicate relatively good solutions in a current sample. The preference model is a set of decision rules inferred by Dominance-based Rough Set Approach (DRSA). The most complex case involves multiple objectives and uncertainty. Feasible solutions are characterized by some quantiles of distributions of objectives over possible scenarios. DRSA based on first- or second-order stochastic dominance is producing decision rules exploited by an evolutionary MOO.
Stuctures and Algorithms on Graphs
Stream: Graphs and Networks
Invited session
Chair: Marc Demange, ESSEC Business School, avenue B. Hirsch, BP 50105, 95021 , Cergy Pontoise, France, demange@essec.edu

1 - Accelerating A*: smart search for and usage of seglines

Felix Hahne, Betriebswirtschaft und Wirtschaftsinformatik, Stiftung Universität Hildesheim, Samelsonplatz 1, 31141, Hildesheim, Germany, hahne@bw1.uni-hildesheim.de, Curt Nowak, Klaus Ambrosi

For shortest-path problems based on real world road-maps, the number of iterations of A* can be decreased by using a tighter estimator for the remaining distance to the target than the Euclidian. Obstacles ignored by the Euclidian can in contrast be taken into account by using segmentation lines (SegLines) modeling their extent and yielding a better estimator. We will both identify obstacles precisely and smartly sketch their shape with SegLines algorithmically. Furthermore different techniques are presented on how to efficiently exploit this information to accelerate A*.

2 - Recognising twin-constrained Hamiltonian threshold graphs

Kai Helge Becker, Department of Management, London School of Economics, Operational Research Group, Houghton Street, WC2A 2AE, London, United Kingdom, k.h.becker@lse.ac.uk

For an undirected graph G with an even number of nodes and a bijective function b on the node set that assigns to each node i a "twin node" b(i), we define a graph G' by adding to G the edges i,b(i). We call G "twin-constrained Hamiltonian with respect to b" if there exists a Hamiltonian cycle on G' in which every node has its twin node as successor (or predecessor). We analyse the case where G is a threshold graph (TG) and show how, for a given b, twin-constrained Hamiltonian TGs can be recognized in polynomial time. The problem has an application in the paper industry.

3 - Some characterization of different classes of g-graphs

Cerasela Tanasescu, ESSEC Business School, Bucharest, Romania, tanasescu@essec.edu

There are significant interactions between group theory and graph theory. An example is provided by Cayley Graphs. Their regularity and underlying algebraic offers many applications of these graphs in the frame of communication networks. G-Graphs constitute another family of graphs constructed from groups. These graphs have also highly-regular properties. The purpose of this presentation is to propose some caracterizations of G-Graphs and to show that well-known infinite families of graphs are G-Graphs, some of them are not Cayley Graphs.

4 - Some inverse chromatic number problems

Yerin Chung, CERMSEM, Université Paris 1, 106-112 boulevard de l’Hôpital, 75013, Paris, yerin.chung@malix.univ-paris1.fr, Culus Jean-François, Marc Demange

We consider an inverse chromatic number problem in interval graphs: we are given an integer K and an interval graph associated with a list of intervals. The intervals are to be newly positioned with the least possible discrepancies from the original positions in such a way that the new related interval graph is K-colorable. We propose a model involving this problem called inverse booking problem. We show that it is hard to approximate in general case with no constraints on lengths of the intervals. We then study the tractability of the sub-problem with a limited number of interval lengths.
The basic evacuation model is a dynamic network flow problem with additional variables for the number and direction of used lanes and with additional complicating constraints. Because of the size of the time-expanded network due to the detailed modeling of intersections and, of course, to the fact being time-expanded, the computational effort required by standard software is already very high for tiny instances of the basic mixed integer evacuation model. To deal with realistic instances we propose a heuristic approach that can manage this problem.

4 - A variational inequality approach for dynamic spatial auction market problems

Adriana Gnudi, Mathematics, Statistics, Computer science and Applications, University of Bergamo, Via dei Caniana, 2 24127 , Bergamo, Italy, adriana.gnudi@unibi.it, Elisabetta Allevi, Igor Konnov

In the talk we consider spatial equilibrium models utilized for description of complex systems taking into account the spatial distribution of interacting elements. For economic systems related to natural monopolies it seems suitable to utilize auction type market mechanisms. We consider systems of auction markets joined by transmission lines subject to joint balance and capacity flows constraints for a certain time period and we propose a primal-dual system of variational inequalities whose solutions yield an equilibrium trajectory. A splitting type method is utilized to find a solution.

3 - A data mining approach on poi based traffic flow estimation - an industrial case study

Thomas Liebig, Knowledge Discovery, Fraunhofer IAIS, Schloss Birlinghoven, 53754 , Sankt Augustin, Germany, thomas.liebig@iais.fraunhofer.de

Estimating traffic flow became business critical for the German outdoor advertisement market, because each transaction depends on the reach estimation: How many people are reached by a campaign? Fraunhofer IAIS develops many data mining algorithms that answer both questions for different scenarios. In this work, we present a method that uses no frequency counts but points of interesting locations (POI) and the total number of pedestrians. We utilise model trees to compute frequency estimates and show and evaluate this approach on a public building scenario taken from an industrial project.

WC-20

DEA Applications V

Stream: DEA and Performance Measurement

Invited session

Chair: Yannis Smirlis, University of Piraeus, Karatiol, Dimitriou 80, 18534 Piraeus, 18534, Piraeus, smirlis@uniipi.gr

1 - Input-output tables and network dea: efficiency of the 47 prefectures of Japan

Hirofumi Amatatsu, Information Science of Graduate School of Engineering, Seikei University, 3-3-1 Kichijoji-Kitamachi, 180-8633, Musasino-shi, Tokyo, Japan, amatatsu@mint.ocn.ne.jp, Tohru Ueda

In organizations described in input-output tables, each sector produces goods for other sectors, and similarly, each sector receives goods from other sectors. We refer to this type of organization as a matrix-type organization. We propose algorithms of network DEA to measure the super-efficiency of network DEA. Then we apply the proposed algorithms to the input-output tables of the 47 prefectures of Japan and investigate their industrial efficiencies.

2 - An integrated approach of performance management in public parking lot

Gaea Lin, Department of transportation, Taipei City Government, 6F, NO. 1, SHI FU ROAD, TAIPEI, TAIWAN, R.O.C., 110, TAIPEI, TAIWAN, R.O.C., Taiwan, D92520005@ntou.edu.tw, Tzay An Shiau

This paper is to construct the integration model of appraising the operational performance of public parking lot in Taipei. The model differs from previous models in that it also assessed the policy mission of completion and evaluated operational performance.
2 - Cones of nonnegative quadratic pseudo-boolean functions and lift-and-project hierarchies

Endre Boros, RUTCOR, Rutgers University, 08854, Piscataway, New Jersey, United States,
Endre.Boros@rutcor.rutgers.edu, Miguel Anjos,
Michel Minoux, Gabriel Tavares

We study lift-and-project closures of the standard linearization of max-2-sat problems and conical hierarchies based on posiform representations of the objective function.

3 - Some properties of the boolean quadric polytope

Isabella Lari, Statistics, La Sapienza University,
Piazzale Aldo Moro 5, 00186, Rome, Italy,
isabella.lari@uniroma1.it, Endre Boros

We study the structure of some facets of the Boolean Quadric Polytope, which is obtained from the standard linearization of unconstrained 0-1 quadratic programming. Padberg (1989) has identified three classes of facets. Boros, Crnajic and Hammer (1990, 1992) have proved that the facets can be classified in a hierarchy where each level is defined by exactly those facets corresponding to non-negative 0-1 functions with at most a given number k of variables. They have determined all facets for k = 3. We provide all facets and find some properties for k = 4, 5.

4 - Quadratic -1,0,1 optimization

Andrea Lodi, D.E.I.S., University of Bologna, Viale Risorgimento 2, 40136, Bologna, Italy,
andrea.lodi@unibo.it, Christoph Buchheim, Alberto Caprara

We present a fast branch-and-bound algorithm for minimizing a convex quadratic objective function over integer variables. In each node of the enumeration tree, a natural lower bound is given by the continuous minimum of the restricted objective function. We improve this bound by considering lattice-free ellipsoids that are determined by a reduced lattice basis. In practice, this approach performs well mainly because all expensive calculations can be done in a preprocessing phase, while the running time for a single node in the enumeration tree is at most quadratic in the problem dimension.

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**WC-21**

Wednesday 11:20-12:40

Hauptmann

Nonlinear 0-1 optimization

Stream: Boolean Programming

**Invited session**

Chair: Bruno Simeone, Dept. of Statistics, University of Rome La Sapienza, Piazzale Aldo Moro 5, 00185, Rome, Italy, bruno.simeone@uniroma1.it

Chair: Isabella Lari, Statistics, La Sapienza University, Piazzale Aldo Moro 5, 00186, Rome, Italy, isabella.lari@uniroma1.it

1 - Nonlinear 0-1 optimization by reduction to max-cut

Christoph Buchheim, Computer Science Department, University of Cologne, Pohligstr. 1, 50969, Cologne, Germany, buchheim@informatik.uni-koeln.de,
Giovanni Rinaldi

Nonlinear 0-1 optimization problems are usually much harder than their linear counterparts. Maximizing a quadratic objective function over binary variables is NP-hard even in the unconstrained case, where it is equivalent to the maximum cut problem. On the other hand, the latter problem has been well-studied. Many results have been obtained for the corresponding cut polytopes, which have led to practically fast algorithms for max-cut and unconstrained quadratic 0-1 optimization. We discuss how to extend these results to general pseudo-boolean and constrained quadratic 0-1 optimization.
2 - Intangibility-aware assessment of building systems based on small prefabricated structural components

Andrzej Słodziński, Faculty of Civil Engng., Opole University of Technology, ul.Katowicka 48, 45-061, Opole, a.slodzinski@gmail.com, Miroslaw Dytczak

The paper deals with ranking of building systems applied for erection of contemporary single-family dwelling houses. A number of quality criteria related to civil engineering technology issues are included. Choice of considered technology issues, assessment criteria and indicators is based on a detailed analysis of existing building market requirements. Analytic Hierarchy Process approach is utilised for assessment of building systems. Numerous variable and intangible market issues are included during the AHP analysis.

3 - System for validation of real estate value estimation

Miroslaw Dytczak, Institute of Spatial Management and Housing ISMH, ul. Targowa 45, 03-728, Warsaw, Poland, mdytczak@rsnot.com.pl, Maciej Szpringier, Grzegorz Ginda

Real estate value depends on numerous factors of both tangible and intangible nature. Diverse issues should be included to assess the value adequately. Necessity to include numerous factors and a considerable level of subjectivism with regard to assessment of their influence can result in big difference of outcomes of distinct estimations. Therefore, a need arises to justify obtained results. The need is especially evident in case of real estate sold by government agencies. A validating approach is proposed in the paper. It is based on parallel application of AHP/ANP and other MCDA methods.

4 - Intangibility-aware decision-making support for printed works preparation

Miroslaw Dytczak, Institute of Spatial Management and Housing ISMH, ul. Targowa 45, 03-728, Warsaw, Poland, mdytczak@rsnot.com.pl, Ewa Kołodziejuk

The effects of printed works preparation depend on numerous tangible factors e.g. the economical factor. However, the main aim of the works is to transmit particular essence to a target reader. Therefore, issues with regard to effects of the essence transmission ought to be included during the works preparation. The issues can be of intangible nature. The presence of numerous and intangible factors causes a need for application of advanced decision making support approaches to obtain optimal form of the works. Application of such approach for the works layout choice is discussed in the paper.

Decision-tree classifier algorithms are usually implemented as integrated solutions. We analyzed the design of famous decision-tree algorithms (ID3, C4.5, CHAID, CART, and QUEST) and identified patterns in these algorithms. By combining the identified patterns one can: generate original algorithms, improve original algorithms and generate new algorithms. In addition all patterns can be documented well, experimented with to find rules that would help choosing a design pattern based upon user and data (type, distribution, correlation, etc) demands. Patterns can be used as decision-support tools.

2 - Consistency in ahp-collaborative decision making

María Teresa Escobar, Grupo Decisión Multicriterio Zaragoza, Universidad de Zaragoza, Gran Vía, 2-4, 50005, Zaragoza, Spain, mescobar@unizar.es, José María Moreno-jimenez, Juan Aguarín

This paper presents a new decisional tool that based on the concept of consistency deals with collaborative decision making in AHP. The procedure starts by identifying the precise values from the common consistency intervals that maximize the minimum available slack of consistency. In a second step the attitude that decision makers have towards the collaboration is incorporated. The preference structures derived from the resulting matrix, named Collaborative Consistency Consensus Matrix, reflect the position which the decision makers have achieved through collaboration and consistency.

3 - Academic decisions support systems: a methodology

José G. Hernández R., Gestión de la tecnología, Universidad Metropolitana, Distribuidor universidad, autopista, Guarenas, 78239, Caracas, 1074, Miranda, Venezuela, jhernandez@unimet.edu.ve, María J. García G.

Objective of this work is to present and tell how it works and how has been created the Integrating-Adaptable Methodology for the development of Decisions Support Systems (IAMDSS), which is created to facilitate the construction of Decisions Support Systems, of academic character.

The methodology for the development of the work is the scientific method for the decisions making and the results turn out to be reflected not only for creation of the IAMDSS but for a wide group of Decision Support Systems that have been constructed making use of it.

KW: DSS, Methodology, IAMDSS, Academic

4 - A new way of classifying and comparing systemic methodologies

Kalliopi Peponi, Department of Product and Systems Design Engineering, University of the Aegean, Konstantinoupoleos 2, 84100, Syros, Greece, lina@aegean.gr, Argyris Arnellos, ThomasSpyrou, John Darzentas

The purpose of this paper is to present a new framework for the classification of the systemic methodologies, applied in organizational design, using basic concepts of systems thinking as a point of reference. The proposed framework would help the organizational designers to better understand the methodologies, give them the ability to choose the most appropriate one for each specific situation, and provide them with the additional advantage of creating hybrid methodologies, combining elements of different ones. The proposed framework is applied in three methodologies (VSM, SSM, and CSH).
Mutiojective Optimization

Stream: Nonlinear Programming
Invited session

Chair: Jorge Sá Esteves, Dep. of Mathematics, University of Aveiro, Campus Santiago, 3810-193, AVEIRO, Portugal, saesteves@ua.pt

1 - The call centers staffing problem: a multicriterion approach

Jorge Sá Esteves, Dep. of Mathematics, University of Aveiro, Campus Santiago, 3810-193, AVEIRO, Portugal, saesteves@ua.pt

A call center is a service network in which agents provide telephone-based services. Customers who seek these services are delayed in tele-queues. This talk addresses optimal staffing of call centers, modeled as a multidimensional M/M/N queue with N, the number of agents, being large. The problem is formulated by using a tricriteria approach (economic criteria, overall efficiency criteria and equity criteria). An algorithm for traveling on the set of Pareto optimal solutions is proposed and computational results are presented.

2 - A lexicographic approach for multi-objective dynamic portfolio optimization

Bartosz Sawik, Department of Applied Computer Science, AGH University of Science & Technology, Faculty of Management, Al. Mickiewicza 30, PL-30-059, Krakow, Poland, B_Sawik@yahoo.com

Mixed integer programming formulation with a lexicographic approach is proposed for dynamic portfolio optimization over many investment periods, each consist of 250 historic quotations. The objective is to allocate wealth on securities to maximize the portfolio return. The constraints and the decision variables are of two types: the upper and lower bounded variables and the nonnegative variables. The algorithm is an extension of the direct support method to solve a multiobjective linear program.

Radjef Sonia, USTO university, Oran, 31000, Oran, Oran, soniaradjef@yahoo.fr

In multicriteria optimization, several objective functions, conflicting with each other, have to be optimized simultaneously. Here, we propose an efficient method for defining the solution set of a multiobjective programming problem, where the objective functions involved are linear, the set of feasible points is a set of linear constraints and the decision variables are of two types: the upper and lower bounded variables and the nonnegative variables. The algorithm is an extension of the direct support method for solving a single-objective linear program.

Marta Pascoal, Departamento de Matemática, Universidade de Coimbra, INESC-Coimbra, Large D. Dinis - Apartado 3008, 3001-454, Coimbra, Portugal, marta@mat.uc.pt

The number of hops (or arcs) of a path is a frequent objective function with applications when network resources utilization is to be minimized. We solve bicriteria path problems involving that objective function and 2 other metrics, the path cost and the path capacity. We introduce labeling algorithms using a breadth-first search tree in order to compute the maximal and the minimal sets of non-dominated paths. The properties of this data structure are explored to better suit the number of hops function. Computational experiments on random problems are reported and discussed.

Graph Games

Stream: Cooperative Game Theory
Invited session

Chair: Agnieszka Rusinowska, CNRS - University of Lyon 2, GATE, 93 Chemin des Mouilles, BP 167, 69131, Ecully, rusinowska@gate.cnrs.fr

We study cooperative games with limited cooperation possibilities. We introduce natural extensions of the average tree solution [see Herings, van der Laan, Talman, 2008]: the marginalist tree solutions and the random tree solutions. We provide an axiomatic characterization of each of these sets of solutions. By the way, we obtain a new characterization of the average tree solution.

Sylvain Béal, GREDEG, University of Nice Sophia Antipolis, 250 rue Albert Einstein, 06560, Valbonne, beals@gredeg.cnrs.fr, Eric Rémiña, Philippe Solal

We address a framework leading to games with communication graphs, where the set of feasible coalitions forms a poset whose all maximal chains have the same length. We analyze for these games the set of order-compatible values, and focus on some of them. We propose an application the study of the behavior of a random walker in a graph, where it is shown that the Shapley value is the most natural solution concept. By observing these graphs in the context of the electric networks theory, we consider notions such as potential drop, current, resistance and power, which find here an equivalent.

Fabien Lange, Keleti Faculty of Economics, Budapest Tech, Tavaszmező u. 15-17, 1084, Budapest, Hungary, fabien.lange@kgk.bmf.hu

We address a framework leading to games with communication graphs, where the set of feasible coalitions forms a poset whose all maximal chains have the same length. We analyze for these games the set of order-compatible values, and focus on some of them. We propose an application the study of the behavior of a random walker in a graph, where it is shown that the Shapley value is the most natural solution concept. By observing these graphs in the context of the electric networks theory, we consider notions such as potential drop, current, resistance and power, which find here an equivalent.

Marco Slikker, IEIS, Technische Universiteit Eindhoven, P.O. Box 513, 5600 MB, Eindhoven, m.slikker@tue.nl, Peter Borm, Rene van den Brink

We deal with the ranking problem of the nodes in a directed graph. We introduce scoring methods, indexed by a single nonnegative parameter α. This parameter reflects the internal slackening of a node within an underlying iterative process. The class of so-called internal slackening scoring methods consists of the limits of these processes. It is seen that for α=0 and α→∞ these methods extend the Invariant and the Fair Bets scoring method, respectively. For α=1, a compromise between the extremes, it corresponds with the λ-method of Borm et al. (2002). A social choice application is included.
Transportation and Logistics

Stream: Discrete Optimization

Chair: Christian Huber, Institut für Fördertechnik und Logistiksysteme, Gotthard-Franz-Str. 8, 76131, Karlsruhe, BW, Germany, christian.huber@ifl.uni-karlsruhe.de

1 - Solving the vehicle positioning problem
Carlos Cardonha, Optimization, ZIB, Takustrasse 7, Berlin-Dahlem, D-14195, Berlin, Berlin, Germany, carlos.cardonha@gmail.com, Ralf Böndörfer

The Vehicle Positioning Problem (or Depot Management Problem) consists of the assignment of vehicles to parking positions and to timetabled trips. The assignments are constrained by the depot topology and by the vehicle types accepted by the trips. We present solutions based on linear integer programming and quadratic integer programming for the problem and compare them from a theoretical and a computational point of view. In particular, we can show that quadratic programming yields the first nontrivial lower bound on problems that require shunting.

2 - Automatic generation of continuous queries for event-based logistics monitoring
Kerstin Werner, SAP Research CEC Dresden, SAP AG, Chemnitzer Strasse 48, 01187, Dresden, Germany, kerstin.werner@sap.com

The potential of distributed event data captured by modern Auto-ID technologies is currently not efficiently used to enable real time logistics monitoring. This is due to the domain specific knowledge and cumbersome design time generation of queries required by existing event processing mechanisms. We introduce approaches to integrate event data and run automatically generated continuous queries on it to detect quality constraint violations. Our formal model of existing SQL-based event query languages allows for the dynamic adaptation of queries according to frequently changing business needs.

3 - Throughput analysis of manual order picking systems with blocking
Christian Huber, Institut für Fördertechnik und Logistiksysteme, Gotthard-Franz-Str. 8, 76131, Karlsruhe, BW, Germany, christian.huber@ifl.uni-karlsruhe.de

In manual order picking systems blocking might occur when pickers cannot pass each other due to narrow aisles. Thus order lead times will increase with each additional picker in the system. First results of a DFG-funded research project seeking to quantify system performance will be presented. To consider the dynamic effects caused by blocking, queuing models are applied to an exemplary system and average order lead times are calculated. The analysis shows that throughput is systematically overestimated when using static approaches for the evaluation of such systems.

4 - Non-dominated time-window policies in city distribution
Derya Eren Aksoy, Department of Industrial Engineering, Dokuz Eylul University, Buca, 35160, IZMIR, Turkey, derya.eren@deu.edu.tr, René de Koster

Local authorities in Western European countries try to improve social sustainability issues in urban areas by applying time-window regulations. Such regulations reduce the hinder for the shopping public. However, increasing time window pressure significantly affects retailers’ distribution costs and has potentially negative impacts on the environment. The objective of this research is to find cooperative and non-cooperative non-dominated policies for municipalities by taking into consideration the conflicting objectives of the municipalities and the retailer.
During warehouse operations open locations tend to spread over the storage area, which negatively impacts load retrieval times. We present a method to manage these open locations such that the system travel time for processing storage and retrieval jobs is minimized. We introduce the effective storage area (ESA); those locations closest to the depot containing all products, but only a part of the open locations. We determine the optimal number of effective open locations and the ESA boundary. This policy reduces the travel time for storage and retrieval jobs by more than 10% on average.

4 - Real options with multi-dimensional state variables

Michi Nishihara, Graduate School of Economics, Osaka University, 1-7, Machikaneyama, Toyonaka, Osaka, 560-0043, Osaka, Japan, nishihara@econ.osaka-u.ac.jp

This paper investigates the real options written on a multi-dimensional underlying stochastic process. Although many models of real options are based on a one-dimensional optimal stopping problem because of its analytical simplicity, those models cannot treat real options related to several projects. We use a multi-dimensional optimal stopping problem in order to represent the specific risk of each project. We analytically show the features of the optimal investment strategy and the option value, and then clarify how they are changed from the one-dimensional case.

2 - Fixed-income portfolio in serbia —hedging against changes in Svensson model parameters

Mikica Drenovak, Operational research, Statistics and IT, Faculty of Economics, Djure Pucara Sturog 3, 34000, Kragujevac, Serbia, Serbia, mikicadrenovak@yahoo.com

This paper aims to determine the potential of hedging Serbian fixed-income portfolio against changes in Svensson model parameters. Dataset underlying this research comes from Serbian euro denominated sovereign bonds. We attempt to discover limitations of these semi hedged strategies and to provide scenarios implying their dominance compared to alternative strategies. Obtained results are consistent with idiosyncrasies of Serbian spot yield curves.

3 - Dynamic evolution for risk-neutral densities

Ana Monteiro, School of Economics, University of Coimbra, Av. Dias da Silva, 165, 3004-512, Coimbra, Portugal, ammmm@fe.uc.pt, RehaTTYUnci, Luis Nunes Vicente

Given the prices of a set of options on the same underlying asset with different strikes and maturities, we propose a nonparametric approach for estimating the evolution of the risk-neutral density in time. Our method uses bivariate splines and an optimization model to choose the spline functions that best fit the price data. Semidefinite programming is employed to guarantee the nonnegativity of the densities. We also used the risk-neutral densities that we computed to price exotic options.
In the latest years, there is increasing convergence between liberalized gas and electricity markets, driven mainly by CCGT investments. Changes in gas prices directly impact on electricity variable cost structures and consequently, in the different players’ strategies and short term optimization decisions. Taking into account several facts and figures from the Spanish energy sector, the purpose of the session is to give an overview of the opportunities, advantages, problems and risks of gas-electricity arbitration from an IPP prospective, which is the role of GdF Suez in the country.

4 - Design of the bidding curve in uniform-price electricity auctions: pricing operational constraints under non-convexity

Miguel Vázquez, Comillas University, Sta. Cruz de Marcenado 26, Madrid, Spain, 28015, Madrid, mvazquez@ii.unicomillas.es, Carlos Vázquez

We consider a power producer selling her output in a pool. Then, the problem may be modeled as a profit-maximization program, where income is defined by the residual demand. It can be proved that in such a case, any bid curve containing the optimal solution is optimal. However, when uncertainty is considered, the production dispatched by the market clearing may be different of the optimal output, and may result in negative profits. We propose a new methodology to design a bid curve that ensures that in any point of the bid curve, the income of the producer is maximized.

WC-30

Wednesday 11:20-12:40
GSI - S 26

Nonsmooth Optimization in MP and Its Applications

Stream: Nonsmooth Optimization and Its Applications

Invited session

Chair: Antonio Fuduli, Department of Mathematics, Universita’ della Calabria, Via P. Bucci, CUBO 31B, 87036, Rende, Italy, antonio.fuduli@unical.it

1 - Separation of convex sets by sets

Diethard Pallaschke, Statistics and Mathematical Economics, University of Karlsruhe, Kaiserstr. 12, Geb. 11.40, D-76128, Karlsruhe, Germany, lh09@rz.uni-karlsruhe.de, Ryszard Urbanski

Two compact convex subsets A and B of a topological vector space X are separated by an other compact convex set S if for every point of A and B the line segment joining this two points intersects S. This is a generalization of the separation by a hyperplane. There exists an algebraic characterization for this type of separation, called the separation law. It is shown that the separation law is equivalent to the order cancellation law.

2 - A new solution method for equilibrium problems

Massimo Pappalardo, Matematica Applicata, University of Pisa, Via Buonarroti 1c, 56127, PISA, pappalardo@dma.unipi.it

A globally convergent algorithm for equilibrium problems with differentiable bifunctions is proposed. The algorithm is based on descent directions of a suitable family of gap functions. The novelty of the approach is that assumptions which guarantee that the stationary points of the gap functions are global optima are not required.

3 - A globally convergent descent method for nonsmooth variational inequalities

Mauro Passacantando, Dipartimento di Matematica Applicata, Università’ di Pisa, 56127, Pisa, Italy, passacantando@dma.unipi.it, Barbara Panicucci, Massimo Pappalardo

We propose a descent method via gap functions for solving nonsmooth variational inequalities with a locally Lipschitz operator. Assuming monotone (not necessarily strongly monotone) operator and bounded domain, we show that the method with an Armijo-type line search is globally convergent. Finally, we report some numerical experiments.
The paper develops a methodology to solve cost-sensitive classification tasks by integrating the random forest classifier with the MetaCost algorithm. A popular approach to take asymmetric misclassification costs into account is the use of statistical decision theory, which involves a post-processing of model predictions. A theoretical advantage of the integrated algorithm stems from the fact that cost-sensitivity is accounted for during learning, i.e. in an earlier stage. Empirical experiments are conducted to verify that the proposed solution offers superior predictions.

4 - Maximum tolerance and maximum greatest tolerance of strict separating systems

Xavier Molinero, Lenguatges i Sistemes Informàtics, Escola Politècnica Superior d’Enginyeria de Manresa, Av. Bases de Manresa, 61-73, 08242, Manresa, barcelona, molinero@lsi.upc.edu, Josep Freixas

An important consideration when applying neural networks is the sensitivity to weights and threshold in strict separating systems representing a linearly separable function. Two parameters have been introduced to measure the relative errors in weights and threshold of strict separating systems: the tolerance and the greatest tolerance. Given an arbitrary separating system we study which is the equivalent separating system that provides maximum tolerance and maximum greatest tolerance.

WC-32

Wednesday 11:20-12:40
GSI - S 4
Portfolio and Risk Management
Stream: Financial Modelling
Contributed session
Chair: Peter Letmathe, Chair of Value Chain Management, University of Siegen, Hoelderlinstr. 3, 57076, Siegen, Peter.Letmathe@uni-siegen.de

1 - Volatility forecast in financial time-series using evolutionary computing techniques

V L Raju Chinthhalapati, Mathematics, London School of Economics, Houghton Street, London, WC2A 2AE, London, v.l.chinthhalapati@lse.ac.uk

We introduce a preliminary framework for forecasting 5-day annualized volatility in GBP/USD, USD/JPY, and EUR/USD. It employs a series of standard and non-standard forecasting methods. We modify and employ Genetic Programming (GP) technique that is suggested by Neely and Weller for volatility forecasting. One challenge with volatility forecast using GP is that the learning samples form a Markovian process. We determine how many training examples must be presented to the GP in the learning phase for the learning to be successful under the Probably Approximately Correct paradigm.

2 - Generating portfolio selection strategy under the lipschitz constant derivations’ scope

George S. Androulakis, Department of Business Administration, University of Patras, University Campus, GR-265 04, Rio, Greece, gandrou@upatras.gr, Eleni Lisiagar

Recently, we proposed an algorithm incorporating with the usage of the Lipschitz constant towards allocating any time series’ future local optima. In the case of stock’s movement - that is according to time, the allocated future local optima corresponds to the ideal future time to negotiate the stock. By applying this scheme simultaneously on a range of stocks it is possible to generate strategy of efficiently selecting the most qualified ones. Moreover, for the efficient management of the selected portfolio a recently proposed lexicographic optimization technique is deployed.

3 - Restricted optimal retention in stop-loss reinsurance

Roxana Ciumara, Mathematics, Academy of Economic Studies, Calea Dorobantilor, 15-17, 71137, Bucharest, roxana_ciumara@yahoo.com, Vasile Preda, Silvia Dedu

In this paper we propose determining the optimal retention by solving an optimization problem with inequality restrictions imposed on the retention level. We consider two optimization criteria: minimizing VaR and CTE, thus extending results from the literature. We derive conditions for the existence of optimal solution for individual and collective risk models. We prove that the features of the restricted optimal retention are not available in the case of an unrestricted optimization problem. We show the dependence of the two restricted optimal retentions and we give some practical examples.

4 - Portfolio margining: strategy vs risk

Dmytro Matsypura, Discipline of Operations Management and Econometrics, Faculty of Economics and Business, The University of Sydney, Room 478 Merewether Building (H04), 3006, Sydney, NSW, Australia, d.matsypura@econ.usyd.edu.au, Ed Coffman, Vadim Timkovsky

The risk-based approach to margining portfolios with equity derivatives is known to yield substantially lower margin requirements in comparison with the strategy-based approach that has been used for more than 4 decades. The final approval of using the risk-based approach to margining customer accounts by the SEC at the time of the global financial crisis appears to be one of the most puzzling steps in the history of margin regulations. This paper proposes a mathematical and experimental analysis of both approaches, provides recommendations on ways that can achieve adequate margin requirements.

WC-33

Wednesday 11:20-12:40
GSI - S 7
Stochastic methods in Global Optimization
Stream: Global Optimization
Invited session
Chair: Eligius M.T. Hendrix, Computer Architecture, Universidad de Málaga, Campus de Teatinos, ETSI 2.2.28, 29017, Malaga, Spain, eligius.hendrix@wur.nl

1 - Tutorial for stochastic global optimisation algorithms

Eligius M.T. Hendrix, Computer Architecture, Universidad de Málaga, Campus de Teatinos, ETSI 2.2.28, 29017, Malaga, Spain, eligius.hendrix@wur.nl

Stochastic GO Algorithms aim at generating good solutions in reasonable time. The aim is to come to a didactical introduction into the concepts of region of attraction, population, effectiveness and efficiency determination, design experiments etc. Small examples a student can elaborate by hand are used such that the concepts are grasped. Ideas of Sampling in high dimensional space, Multistart, Clustering, Pure Adaptive Search, Hit and Run and SA, Population variants like Controlled Random Search, Raspberries, GA, Particle Swarms etc. are elaborated. A flavour is given in the presentation...
2 - Statistical models for global optimization
Julius Zilinskas, Systems Analysis Department, Institute of Mathematics and Informatics, Akademijos 4, LT 08663, Vilnius, Lithuania, zilinskasjuilus@gmail.com, Antanas Zilinskas

Information about objective functions in many real world applications is scarce and corresponds to the notion ‘black box optimization’. We consider possibilities to enrich this model with some heuristic and statistical information. Available information is structured into a statistical model of multimodal objective functions. Our talk focuses not as much on paradigmatic problems, as on algorithmic implementation of statistical models and the corresponding global optimization algorithms.

3 - Global optimization solution of robust regression using the simulated annealing algorithm
Mevlut Yetkin, Sile University, Sedce, Zeytinburnu, Istanbul, Turkey, meytik@gmail.com

Robust regression may be computed using the usual iterative re-weighted least squares (IRLS) algorithm. However, although easy to compute, IRLS may fall in a locally optimum solution far from the global one. In this paper we study the solution of robust regression as a global optimization problem which can be solved using the simulated annealing (SA) method. This paper shows that the residuals resulting from the SA method have successfully shown the multiple outliers. On the other hand, multiple outlier detection by IRLS has become more difficult.

4 - Achieving global descent in global optimization
Chi-Kong Ng, Department of Systems Engineering and Engineering Management, Chinese University of Hong Kong, Shatin, N/T, Hong Kong, ckn@se.cuhk.edu.hk, Duan Li

A new method is discussed, termed global descent method, to solve a wide class of global optimization problems. The family of global descent functions, constructed at any non-global minimizer \( x^* \), not only have a local minimizer \( x \) over the problem domain, but they are also located in the neighborhood of a better minimizer of \( f(x) \) with \( f(x) < f(x^*) \). This enables a global descent at each iteration by only performing local descent methods. Computational experiments on several test problems with up to 1000 variables have demonstrated the applicability and efficiency of the proposed method.

- Clustering of sequences of different length with a new distance based on the kl divergence
Emilio Parrado-Hernandez, Signal Processing and Communications, Universidad Carlos III de Madrid, Avenida de la Universidad 31, 28911, LEUGANES, emiparr@yahoo.com, Dar Garcia-Garc, Fernando Diaz-de-Mar

We address the problem of clustering sequences of different length. We start describing a general framework for sequence clustering. This framework combines a generative model, namely a Hidden Markov Model, with a clustering algorithm. We review the distance measures that have been proposed in the literature to compare HMMs. We then present a new distance for this framework based on the Kullback-Leibler divergence. The experimental work includes a speaker verification application where this new distance achieves a good performance.

- Re-mining positive and negative associations: does pricing matter?
Ayhan Demiriz, Industrial Engineering, Sakarya University, Esentepe Kampusu, D8 Binasi No:301, 54187, Sakarya, ademiriz@gmail.com, Gurinal Erteke, Ahmet Cihan

Positive and negative association mining are well-known data mining tools to analyze vast amount of retail data. Essentially these mining tasks are performed by utilizing the transaction data. Despite being an important part of the transaction data, the pricing information has long been neglected in data mining research. A novel approach is proposed to incorporate pricing information to the data mining process and to mine the association mining results to generate new rules to understand the driving forces behind positive and negative associations.

- High-dimensional non-linear variable selection through hierarchical
Francis Bach, INRIA - ENS, DI/ENS Ulm, 45, rue d’ULM, 45, rue d’ULM, 75230, Paris, francis.bach@mines.org

We consider the problem of high-dimensional non-linear variable selection for supervised learning. Our approach is based on performing linear selection among exponentially many well-defined groups of features or positive definite kernels, that characterize non-linear interactions between the original variables. We use the hierarchical structure of the kernels to extend the multiple kernel learning framework to kernels that can be embedded in a directed acyclic graph, through a graph-adapted sparsity-inducing norm, in polynomial time in the number of selected kernels.
1 - Mixed and edge search number of some perfect graph classes

Rodica Mihai, Department of Informatics, University of Bergen, HIB, PB 7803, 5020, Bergen, Norway, rodica_mihai@yahoo.com, Pinar Heggernes

Search games in graphs have attracted significant attention in recent years, and they have applications in securing computer networks against viruses and intruders. Since graph searching is an NP-hard problem, polynomial-time algorithms have been given for solving it on various graph classes. Most of these algorithms concern computing node search number of a graph, and only few such algorithms are known for computing mixed or edge search numbers of specific graph classes. We show how to compute in linear-time mixed search number of permutation graphs and edge search number of cographs.

2 - Network discovery and verification

Matus Mihalak, Institute of Theoretical Computer Science, ETH Zurich, 8092, Zurich, Switzerland, matus.mihalak@inf.ethz.ch, Zuzana Beerliova, Alex Hall, Michael Hoffmann, Thomas Erlebach

The Network Discovery problem is an online problem in which the input is the node set of an unknown graph $G=(V,E)$. The goal is to discover all edges and non-edges of $G$ by a minimum number of measurements on $G$. A measurement is specified by a node of $G$, and it returns information about $G$ (e.g., distances to all nodes from the specified node). We consider two different models characterized by different types of measurements. We give several upper and lower bounds on the competitive ratio (the online version) and the approximation ratio (the offline version) in both models.

3 - Digraph searching

Boting Yang, Dept. of Computer Science, University of Regina, 3737 Wascana Parkway, SAS 0A2, Regina, Saskatchewan, Canada, boting@cs.uregina.ca

In this talk we review search problems on digraphs. We present relationships between directed searching models and undirected searching models. We show some upper bounds and lower bounds on search numbers of special digraphs. We focus on the monotonicity and complexity of directed searching problems.

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**BigInteger 2023 - Bonn 2009**

**WC-35**

**Wednesday 11:20-12:40**

**GS1 - S 9**

**Searching Digraphs and Perfect Graphs**

**Stream: Graph Searching**

**Invited session**

**Chair:** Gena Hahn, Informatique et recherche operationnelle, Universite de Montreal, 2920 Chemin de la tour, H3T1J8, Montreal, Quebec, Canada, hahn@iro.umontreal.ca

1 - Mixed and edge search number of some perfect graph classes

Rodica Mihai, Department of Informatics, University of Bergen, HIB, PB 7803, 5020, Bergen, Norway, rodica_mihai@yahoo.com, Pinar Heggernes

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**WC-36**

**Wednesday 11:20-12:40**

**GS1 - S 11**

**Stochastic Modelling and Simulation II**

**Stream: Stochastic Modelling and Simulation**

**Invited session**

**Chair:** Zeev (Vladimir) Volkovich, Ort Braude Academic College, Yehiam 6, 21823, Karmiel, Israel, zeev@actcom.co.il

1 - Statistical games approach to machine learning

Michael Khachay, Ural Branch of RAS, Institute of Mathematics and Mechanics, S.Kovalevskoy, 16, 620219, Ekaterinburg, Russian Federation, mkhachay@imm.uran.ru

A general training pattern recognition task is reformulated in the statistical games theory terms. A special case of the problem, in which a given finite set of patterns is classified with the best quality, is considered. As in the general case, all information about the classes’ distributions is given by finite sample, and the required decision rule is a function from the sample space to the set of colorings of the finite set to be classified. The minimax theorem for several cases of the latter problem is proved. Bayesian approach to the appropriate statistical games is considered as well.

2 - On asymptotical equivalence of statistical criteria in discrete problems

Alexander Grusho, Probability theory, Moscow State University, GSP-2, GSP-2, GSP-2, Moscow, grusho@yandex.ru, Elena Timonina, Zeev (Vladimir) Volkovich, Zeev Barzily

Statistical hypothesis testing can lead in many discrete problems to tedious computational tasks as it is hard to check if the observed values belong to the critical area. Thus, simplified criteria, with possible altered statistical features, are applied. In this paper two criteria groups of simple hypotheses against composite alternatives are considered on a set of finite discrete spaces. The first sequence contains consistent rules and the second one is composed from their simplified versions. We present the conditions for which the second sequence is also consistent for all alternatives.

3 - Measure valued differentiation and series expansions in positive systems

Fazia Aoudia-rahmoune, Operational Research, Laboratory LAMOS University of Bejaia, Laboratory LAMOS University of Bejaia, Traga Ouuzemmour, 06000, Bejaia, Algeria, foufourah@yahoo.fr

Positive Systems are Stochastic Systems in the relevant variables assume a positive values such as queueing systems, traffic models, transportation systems, Markov chains etc. The performance of this systems may be depend on a design parameter. When it comes to sensitivity analysis , control or optimisation, one seeks to compute derivatives. This paper provides series expansions of the stationary distribution of a finite Markov chain. This leads to an efficient numerical algorithm. Numerical examples are given to illustrate the performance of the algorithm.

4 - K-nearest neighbors’ stochastic models in the cluster stability problem

Zeev (Vladimir) Volkovich, Ort Braude Academic College, Yehiam 6, 21823, Karmiel, Israel, zeev@actcom.co.il, Zeev Barzily, Renata Avros

We consider two K-Nearest Neighbors (K-NN) probability models related to the cluster validation problem. The partitions are estimated by pairs of clustered samples. The first model assumes the Binomial Distribution for the amount of K-NN belonging to the point’s sample with a success probability of 0.5. Here, a summarizing p-values index, of the worst cluster, evaluates the partition quality. The second model uses the asymptotical behavior of the K-NN quantity. Numerical experiments exhibit a good capability of the methodologies to detect the true number of clusters.
Decision Theory and Analysis - 2

**Contributed session**

Chair: Mauricio Ruiz-Tagle, Facultad de Cs. de la Ingeniería, Universidad Austral de Chile, General Lagos 2086, Campus Miraflores, Valdivia, Chile, mruiztag@uach.cl

1 - Performance indicators for the motorway infrastructure concession considering the users’ requirements

Maríana Brochado, Road Infrastructure Concession, National Land Transportation Agency, Setor Bancário Norte (SBN), Quadra 2, Bloco C, 70.040-020, Brasília, DF, Brazil, marianabrochado@gmail.com, Javier Faulin

This paper proposes a procedure for the assessment and prioritization of performance indicators of the motorway infrastructure concessionaires’ activities in Brazil. One of the National Land Transportation Agency duties is monitoring these activities to fulfill some required quality standards. A survey with experts was performed using the Quality Function Deployment-QFD. Thus, a quantitative analysis relates the user’s required quality with the technical quality of the road, using a methodology of value theory. Likewise, monitoring activities were prioritized and the road performance defined.

2 - Measuring bank customer behavior

Maria Mavri, Business Administration, University of the Aegean, 8 Michalson Street, 82100, Chios, m.mavri@ba.aegean.gr, Vassilis Angelis, Katerina Dimaki

Banks face the hard competition by understanding the needs of their customer’s and reacting to the changes of their behavior. Customer satisfaction is recognized as being highly associated with customer value. Enhancement of existing relationships with customers is of pivotal importance to banks. Customer’s behavior depends on a multitude of factors, related to bank, to himself and to economical environment. The objective is to “formulate” customer’s behavior, as a continuous function, to identify and quantify the factorial variables and define the form of this specified function.

3 - Perturbation results for retrieving priority vectors from pairwise comparison matrices

Esther Dopazo, Facultad de Informática, Universidad Politécnica Madrid, Campus de Montegancedo, 28660, Boadilla del Monte, Spain, edopazo@ifi.upm.es, Mauricio Ruiz-Tagle, Myriam Serrano

Pairwise comparison matrices play an important role in multicriteria decision making. They are commonly used for assessing the relative importance of several competing alternatives in terms of a single criterion. A wide range of techniques have been developed to compute priority vectors from preference information contained in a pairwise comparison matrix. We consider pairwise comparison matrices subject to perturbations and we evaluate the effect of such perturbations in the solutions given by the different methods. Some parameters are proposed for error analysis.

4 - A model for computing a group priority vector under incomplete information

Mauricio Ruiz-Tagle, Facultad de Cs. de la Ingeniería, Universidad Austral de Chile, General Lagos 2086,
We propose a new Monte Carlo method based on robust regression and the dynamic programming principle in terms of the optimal stopping time for pricing multi-asset American options. By using robust regression instead of ordinary least squares, we are able to get a more accurate approximation of the continuation value due to detection of outliers. We extend approaches for variance reduction by importance sampling for American options, and we focus on stochastic approximation and optimization methods. Overall, we improve convergence in comparison to existing Monte Carlo methods significantly.

**WC-39**

Wednesday 11:20-12:40  
GSI - S 14

Flexible Manufacturing Systems

Stream: Scheduling  
Contributed session

Chair: Mustafa Yuzukirmizi, Dep. of Industrial Eng., Kirikkale University, 71451, Kirikkale, Turkey, myuzukirmizi@kku.edu.tr

1 - A capacity allocation problem with tooling costs in flexible manufacturing systems  
Selin Özpeynirci, Izmir Ekonomi Üniversitesi, Sakarya Ctd. No 156, 35330, Izmir, Turkey, selin.ozpeynirci@ieu.edu.tr, Meral Azizoğlu

In this study we consider a capacity allocation problem in flexible manufacturing systems where a set of operations is assigned to the numerically controlled machines together with their required tools. The usage of the required tools incurs a cost and the machines have limited time and tool magazine capacities. We aim to maximize the net profit, i.e., the total weight of the assigned operations minus the total cost of the used tools. We obtain powerful upper and lower bounds on the optimal profit values using lagrangian relaxation based approaches.

2 - Production scheduling with alternative process plans  
Roman Capek, Department of Control Engineering, Czech Technical University in Prague, Technicka 2, 16627, Prague 6, Czech Republic, Czech Republic, capek11@fel.cvut.cz, Zdenek Hanzalek, Premysl Sucha

We deal with a scheduling problem with alternative process plans. This article is motivated by production of wire bunches where certain parts can be processed manually or using different types of machines. We propose the problem representation based on the Petri nets formalism allowing to define alternatives and parallelism within one data structure. An ILP model is formulated to obtain optimal solution. We suggest a heuristic solution based on resolving resource conflicts by adding new precedence constraints between tasks. Finally we present performance evaluations of the proposed algorithm.

3 - Optimal production strategy under fluctuating demands: technology versus capacity  
Yang Liu, Department of Logistics and Maritime Studies, Hong Kong Polytechnic University, Department of Logistics and Maritime Studies, The Hong Kong Polytechnic University, Hung Hom, Hong Kong, 852, Hong Kong, Hong Kong, lgt.yangliu@polyu.edu.hk, Chi To Ng

This paper provides a comparative analysis of five possible production strategies under fluctuating demands with respect to two kinds of investments, namely flexible technology and flexible capacity. The study formulates a manufacturer’s decision-making operation process comprising technology level, capacity amount, production quantity and price setting. We evaluate each strategy and show how production cost structure, operation timing and investment costing environments affect a firm’s strategic decisions. Our results show that there are no sequential effects of the above two investments.

4 - Multi-class closed queueing network models for flexible manufacturing systems with finite capacities  
Mustafa Yuzukirmizi, Dep. of Industrial Eng., Kirikkale University, 71451, Kirikkale, Turkey, myuzukirmizi@kku.edu.tr

In this study, closed queueing network models for Flexible Manufacturing Systems are analyzed. The system consists of different classes of customers which vary in their service requirements and routes. In the model, the resources may have limited waiting spaces with Blocking After Service mechanism. We study the interference of customer classes, service times and blocking mechanism and derive several useful properties. We present a new state description to obtain equilibrium state probabilities and propose a very practical product-form approximation method.

**WC-40**

Wednesday 11:20-12:40  
GSI - S 27

Sustainable energy systems

Stream: SD modelling in sustainable development  
Invited session

Chair: Erik Pruyt, MOSI, Vrije Universiteit Brussel, Pleinlaan 2, 1050, Brussels, Belgium, epruyt@vub.ac.be

1 - Nuclear phase-out in Belgium: is it sustainable?  
Pierre Kunsch, MOSI, Vrije Universiteit Brussel, Pleinlaan 2, 1050, Brussels, Belgium, pkunsch@vub.ac.be

A law has been passed in 2003 in Belgium for phasing out nuclear power plants (NPP’s) in the period 2014-2025. NPP’s produced in 2008 56% of the electricity in the country. Ecologists argue that the phase-out is a contribution to sustainability, but they do not provide any quantitative analysis. It is doubtful that this production can be replaced by mere energy saving, and renewable energy alone; also NPP’s contribute to avoiding CO2 emissions. A system dynamics model brings more quantitative elements to the debate.

2 - Biofuel OR not? how to evaluate it, that is the question!  
Cathy Macharis, Vrije Universiteit Brussel, 1050, Brussels, Belgium, cjmachar@vub.ac.be, Laurence Turcksin

Several policy measures for biofuel introduction in Belgium will be evaluated. The system dynamics approach will be used to gain insight in the complex behaviour of biofuel markets over time in combination with a Multi-Actor-Multi-Criteria Analysis (MAMCA), developed by Macharis (2000). The MAMCA is a methodology to evaluate policy measures where different stakeholder’s opinions are explicitly taken into account. Here, the stakeholders will be the agricultural sector, biofuel converters, -distributors, end users, car converters, government and NGOs.
of deep uncertainty. This paper analyzes the potential development of European bio-energy and its contribution to a sustainability-led transition of the European energy system. The perspective taken is an exploratory systems dynamics perspective with a strong focus on the exploration of deep uncertainty.

3 - Towards a sustainable energy system? contribution and potentiality of European bio-energy
Erik Pruyl, Faculty of TPM, Policy Analysis Section, Delft University of Technology, Jaffalaan 5, 2600GA, Delft, Netherlands, E.Pruyl@tudelft.nl
During the recent food crisis, bio-energy was often said to increase food insecurity in developing countries. Subsequently, many European biomass projects were canceled, stalling implementation and further development of bio-energy technologies, potentially threatening long-term energy security.

This paper analyzes the potential development of European bio-energy and its contribution to a sustainability-led transition of the European energy system. The perspective taken is an exploratory systems dynamics perspective with a strong focus on the exploration of deep uncertainty.

4 - Application of RFID technology to baggage handling system
Stefano Carrese, Department of Civil Engineering, University of Roma TRE, Via Vito Volterra 62, 00146, Roma, Italy, carrese@uniroma3.it, Marialisa Negro, Stefano Saracchi
The study focus on the application of Radio Frequency Identification Data (RFID) to the Baggage Handling System (BHS) of the National flights Terminal of Fiumicino Airport. BHS presents different problems related to the times needed for the handling and the influence of these times on all the consequent airport operations. Bags can be subject to strong delays, so affecting the flights departure times and they can be lost so reducing the customer satisfaction. RFID permits to optimize the BHS, improving bags tracing, simplifying the identification procedures and ensuring a better security.

[[WC-41]]
Wednesday 11:20-12:40
GSI - S 28
Public Applications of Simulation
Stream: Simulation Applications in Private and Public Organizations
Invited session
Chair: Murat Cuner Testik, Industrial Engineering, Hacettepe University, Hacettepe Universitesi, Muhendislik Fak. Endustri Muh. Bolumu, 06800, Beytepe- Ankara, Turkey, mtestik@hacettepe.edu.tr
Chair: Banu Yüksel Özkaya, Department of Industrial Engineering, Hacettepe University, Hacettepe University, Department of Industrial Engineering, 06800, Ankara, Turkey, byuels@hacettepe.edu.tr
1 - A new approach to electricity spot market modeling
Marcus Hildmann, Swissquant Group AG, Universitätsstrasse 9, 8032, Zürich, hildmann@swissquant.ch, Florian Herzog
Electricity spot markets show different behavior from other markets. The three main properties of spot markets are deterministic intraday, daily and yearly seasonality, stochastic hourly price shocks and skewed and heavy tailed prices. We present a new approach to spot price modeling, by capturing deterministic properties with a linear model with factor selection. Stochastic seasonality and shocks are modeled with structural correlation estimated with a robust factor selection algorithm. Additionally, the skewed heavy-tailed noise is modeled with corresponding distributions, such as skew-t.

2 - Proposal to facilitate the process of adaptation of the balanced scorecard in the third sector for Brazilian educational organization third sector
William Vianna, Production Engineering, Federal University of Santa Catarina, Rua Cônego Bernardo, 100, Ap. 202, 88036570, Florianopolis, Santa Catarina, Brazil, wpwilliam@hotmail.com, Leonardo Ensslin, Edilson Giffhorn
This work is a simulation whose intention is a proposal of an adaptable construction of BSC for a nonprofit educational organization. From the difficulties was objectified to consider a facilitator process of the adaptation to unite the transitory character of the managers and the necessity of to implement corporate strategies at medium and long term. The result is the proposal of a facilitator process to BSC adaptation, composed by two phases: Stage of Consistency Evaluation of the Strategic Planning and Stage of Quality and Stage of Contextualization and the Anchor Strategy choice.

[[WC-42]]
Wednesday 11:20-12:40
GSI - S 3
Recent developments from Nonconvex Programming
Stream: Nonconvex Programming: Local and Global Approaches - Theory, Algorithms and Applications
Invited session
Chair: Rafael Lopez, Mechanical Engineering, INSA Rouen, Avenue de l’Université – BP 8, 76801, Saint-Étienne-du-Rouvray Cedex - France, 76801, rafaelholdorf@gmail.com
1 - A dc programming approach for solving the symmetric eigenvalue complementarity problem
Mahdi Mocti, Computer Science, University Paul Verlaine - Metz, 57045, METZ, France, mocti@univ-metz.fr, Hai An Le Thi, Tao Pham Dinh
We address the Eigenvalue Complementarity Problem (EiCP) and we offer a DC (Difference of Convex functions) programming technique for solving large scale EiCP with real symmetric matrices. This kind of problems arises in diverse engineering and scientific applications. At first, we reformulate EiCP in the form of a DC programming problem and then we apply DCA (DC Algorithm) to solve it. Computational tests show the robustness, efficiency, and high speed of the method in comparison to the commercial softwares.
2 - An efficient discretization method in semi-infinite optimization

Mohand Ouanes, Mathematics, University of Tizi-Ouzou Algeria, University of Tizi-Ouzou, Algeria, 15000, Tizi-Ouzou, ouanes_mohand@yahoo.fr
An efficient discretization method in semi-infinite optimization
In this paper we propose a new decreasing method for solving semi-infinite problems by using an efficient discretization procedure. The method consists in locating all the active points of discretization with the help of a reduced technique in global optimization. The convergence of the proposed algorithm is proved and the numerical experiments on several test problems are presented to show its efficiency.
Keywords: Semi infinite optimization, discretization, Global optimization

3 - Approximating the probability density function of the optimal point of non convex functions

Rafael Lopez, Mechanical Engineering, INSA Rouen, Avenue de l'Université - BP 8, 76801 Saint-Étienne-du-Rouvray Cedex - France, 76801, Saint-Étienne-du-Rouvray, rafaelholderof@gmail.com
This paper aims at approximating the probability density function (PDF) of the optimal point of non convex functions. The polynomial chaos expansion is employed and the resulting functional is minimized using stochastic approximation techniques. Several non-convex functions are analyzed and the validation of the proposed methodology is done comparing its results to those obtained using the Monte Carlo Simulation. The numerical analysis shows that the proposed methodology has successfully approximated the PDF of the solution of the optimization process of all the tested functions.

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WC-43

Wednesday 11:20-12:40
GSI - S 10
Capital Markets and Control
Stream: Long Term Financial Decisions
Invited session
Chair: Wolfgang Bessler, BWL - Finanzierung und Banken, Justus-Liebig-Universität Giessen, Giessen, Germany, Wolfgang.Bessler@wirtschaft.uni-giessen.de

1 - Are private equity investors boon OR bane for an economy? - a theoretical analysis

Christian Koziol, Chair of Corporate Finance, WHU - Otto Beisheim School of Management, Burgplatz 2, 56179, Vallendar, Germany, christian.koziol@whu.edu
We provide a theoretical foundation for the controversial debate about the economic consequences of private equity transactions. Applying a simple model framework, we compare the maximum acquisition prices for the takeover as well as the subsequent optimal investment volumes for both investors to reveal reasons for an inefficient behavior. We find that most of the usual arguments against private equity transactions cannot explain an inefficient behavior by private equity firms, whereas a high amount of leverage and informational advantages can.

2 - Currency-dependent differences in the implied probabilities of default of euro and us-dollar denominated foreign currency sovereign bonds

Andreas Rathgeber, Wirtschaftswissenschaften, Universität Augsburg, Universitätsstraße 16, 86135, Augsburg, Germany, andreas.rathgeber@wiwi.uni-augsburg.de
That credit spread curves at the single-issue level significantly differ across currencies, is proven empirically. Despite a few smaller shortcomings these studies lack of a potential home bias. This work contributes to the literature by analyzing whether these findings also hold for sovereign implied default probabilities. By introducing a dual currency reduced form model the main result is, that the differences are due to the correlation structure between exchange rate and credit risk.

3 - Capital markets and corporate control: empirical evidence from hedge fund activism in Germany

Wolfgang Bessler, BWL - Finanzierung und Banken, Justus-Liebig-Universität Giessen, Giessen, Germany, Wolfgang.Bessler@wirtschaft.uni-giessen.de
During the last decade the German financial system has changed from a bank dominated system to a more financial market oriented system. Most importantly, the corporate governance and corporate control structure underwent significant changes. In fact, hedge funds and other activist investors are increasingly taking advantage of a perceived control vacuum. One interesting question is whether this stronger capital market orientation led to an increase in shareholder value. We find empirical evidence that the engagement of activist shareholders increased shareholder value in the short run.

WC-45
Wednesday 11:20-12:40
GSI - S 33
Modeling and Analyzing Social/Behavioral/Technical OR Problems
Stream: OR Applications in Education
Invited session
Chair: Sevgi Ozkan, Informatics Institute, Middle East Technical University, Ismet Inonu Bulvari, 06531, Ankara, Turkey, sozkan@ii.metu.edu.tr
Chair: Seren Basaran, Secondary Science and Mathematics Education, Middle East Technical University, Informatics Institute - METU, 06531 Ankara Turkey, Turkey, sbasaran@ii.metu.edu.tr

1 - Examining university graduates’ entrepreneurship through the design and an application of an OR survey model

Vassilis Kostoglou, Department of Informatics, Alexander TEI of Thessaloniki, P.O. Box 141, 57400, Thessaloniki, Greece, vkostogl@it.teithe.gr
This work concentrates on the analysis of all principal parameters describing university graduates’ entrepreneurial activities. A survey model has been designed for this purpose and a structured questionnaire was addressed to a large representative sample of self-employed graduates. The impact of factors such as gender, department and faculty of origin, place of residence, marital status, type of secondary education, degree grades and postgraduate studies, on main entrepreneurial issues is thoroughly examined with the use of appropriate statistical analysis.

2 - Modelling personal learning in the use of modern technologies

Jo Smedley, Newport Business School, University of Wales, Newport, Allt-yr-yyn Avenue, Newport, NP20 5DA, Newport, United Kingdom, jo.smedley@newport.ac.uk
Learning and teaching practices in Higher Education have developed rapidly in recent years with the use of modern technologies enabling learning through a range of non-traditional approaches. This presentation discusses a traditional model of learning, suggesting developments to reflect modern technological applications. Case study examples involving experiences by staff and students will demonstrate the value of communities of practice and the impact of subject differences as participants progress through their personal learning stages.

Wednesday 12:55-14:15

WD-01

Beethoven

Industrial Optimization

Stream: Combinatorial Optimization

Contributed session

Chair: Nivaldo Coppini, Industrial Engineering Post Graduation, Uninove University, Av. Francisco Matarazzo, 612, 05001100, São Paulo, São Paulo, Brazil, ncoppini@uninove.br

1 - Optimization for siplace placement systems

Petra Bauer, CT PP 7, Siemens AG, Otto-Hahn-Ring 6, 81370, München, Bayern, Germany, bauer.petra@siemens.com

The challenges our team at Siemens CT is facing in the context of printed circuit board assembly range from optimizing the line performance for a given job to optimizing the overall production process by finding appropriate manufacturing and set-up strategies and providing algorithms in order to support them. We introduce the SIPLACE machines and give insight in manufacturing concepts and setup-strategies as well as the optimization problems we have been working on. Especially, we consider the concept of constant tables that helps our customers to save setup-times and feeder equipment.

2 - Mathematical models for margin calculation

Dmitry Krushinsky, Department of Operations, University of Groningen, Nettelbosje 2, 9747 AE, Groningen, Netherlands, d.krushinsky@rug.nl, Boris Goldengorin

The problem of margin calculation (minimization of regulatory margin requirement) for an account at a brokerage company is considered. For an account containing derivatives it is a non-trivial combinatorial problem. While existing models lack flexibility to adapt to changing regulations and use unjustified heuristics, we propose two classes of models, based on the multidimensional assignment and the p-Median problems, respectively. Our models are free of the mentioned drawbacks and can be used as a tool for constructing the margining system.

3 - A new cutting tool wear detection method using the lifting technique

Nivaldo Coppini, Industrial Engineering Post Graduation, Uninove University, Av. Francisco Matarazzo, 612, 05001100, São Paulo, São Paulo, Brazil, ncoppini@uninove.br, Fabio Pereira, Elesandro Baptista

In order to meet the current requirements of cost, quality and time in the machining process, it is imperative an adequate calibration of working parameters. If a production time reduction can be achieved by choosing higher cutting speeds, it can also accelerate the tool wear at the cutting edge, reducing the cutting tool life and creating quality problems during the machining. This work proposes a new efficient approach to cutting tool wear detection using tool images and the lifting technique. This new approach is described in this paper and results are presented to show its efficiency.

4 - A new relaxation scheme for mpecs

Sonja Veelken, Zentrum Mathematik, M1, Technische Universität München, Boltzmannstr. 3, 85748,
This study proposes a Cross Entropy based heuristic for solving the vehicle routing problem with time windows. A set of probability distributions corresponding to available number of vehicles are utilized independently to guide these vehicles towards optimal routing paths. Based on the minimization of cross entropy, optimal transition probability is iteratively estimated. The advantage of the proposed approach resides on its mathematical property based on important sampling theory. The Solomon’s 100-customer benchmark instances are tested to demonstrate its efficiency and effectiveness.

**WD-03**

Wednesday 12:55-14:15

Reger

**TRAFFIC CONTROL**

Stream: Transportation

*Invited session*

Chair: Bernhard Friedrich, Institut für Verkehr und Stadtentwicklung, Technische Universität Braunschweig, Pockelsstr. 3, Braunschweig, 38106, Braunschweig, Germany, friedrich@tu-braunschweig.de

1 - Data fusion techniques for traffic state estimation - dino within dmotion

Daniel Schmidt, Leibniz Universität Hannover, Institut für Transport, Road Engineering and Planning, Appelstr. 9A, 30167, Hannover, Germany, schmidt@ivh.uni-hannover.de, Bernhard Friedrich

This paper presents the data fusion techniques in the R&D project - Dmotion, in which the system of real-time traffic state estimation (DINO) has been further developed. DINO is an iterating two phase algorithm: an assignment of the Origin-Destination-Matrix (3DAS, de Romph) and a calibration of the OD-Matrix (information simulation algorithm, van Zuylen). One data fusion technique is to involve Floating Car Data into the calibration algorithm. By specifying a travel time based classification an indirect calculation of correction factors within the calibration algorithm is used.

2 - Practical offset optimization in urban road networks based on cell transmission model and genetic algorithms

Jannis Rohde, Institute of Transport, Road Engineering and Planning, Leibniz Universität Hannover, Appelstraße 9A, 30167, Hannover, Germany, rohde@ivh.uni-hannover.de, Bernhard Friedrich

The CTM by Daganzo was enhanced in order to deal with urban road networks characteristics, i.e. signalized multi-lane junctions and flow reductions for left-turning streams. The combination of CTM, GA and a graphical user interface allows for quick and elaborate offset optimization. The user can choose between several decision variables: delay times, number of stops, emissions and fuel consumption. This approach was applied to a real urban road network in Hannover. The impacts on all decision variables were analysed using microsimulations as well as before-after studies of real travel times.

3 - Concept for a decentralized adaptive traffic signal control in urban networks based on c2i-communication data and adaptive dynamic programming (adp)

Christian Priemer, Institute of Transport, Road Engineering and Planning, Leibniz Universität Hannover, Appelstr. 9a, 30167, Hannover, Germany, priemer@ivh.uni-hannover.de
The paper provides a concept to process in future available C2I-data within a new traffic signal control in urban networks based on ADP. The received C2I-data will be used to forecast arrival pattern and queue lengths within each access lane. Due to the low or medium penetration rate on communication cars assumed in the near future, the received C2I-data are not sufficient to obtain validated arrival pattern and queue length. Hence, a method for queue length estimation will be used to generate additional sufficient input data for the ADP algorithm to optimize traffic signal control.

**Parallel Machine Scheduling**

Stream: Scheduling

**Invited session**

Chair: Müge Muhafluz, Korutürk Mah. Vali Hüseyin Öbütcen Cad. No 19 D3 Balço, 35330, İzmir, mmuhafluz@gmail.com

**1 - Parallel machine scheduling with preparation times**

Wafaa Labbi, Faculty of Mathematics, USTHB University, BP 32, El-Alia, Bab-azzouar, 16111, Algiers, fawalab@yahoo.fr, Mourad Boudhar

The aim of this article is to study the scheduling problem of n jobs on m identical parallel machines, no preemption is allowed in presence of k specialized workers to minimize the makespan. In this context, the presence of specialized workers is necessary to prepare the machines and jobs. In the first time we propose an approximation algorithm based on linear programming formulations. Later on, we prove the NP-hardness of the general problem and we proposed lower bound. Polynomial subproblem, also, heuristic algorithms are presented with numerical experimentations.

**2 - New algorithms for unrelated parallel machine scheduling problem**

Ruben Ruiz, Departamento de Estadística e Investigación Operativa Aplicadas y Calidad, Universidad Politécnica de Valencia, Camino de Vera S/N, 46021, Valencia, Spain, ruizr@ioe.upv.es, Luis Fanjal Peyro, Thijs Urlings

We consider the unrelated parallel machine scheduling problem. We present several novel algorithms, one based in iterated greedy (IG) methods, two based on Restricted Local Search (RLS), three more based on specific structural properties of the problem. Lastly, we also present a heuristic that is a hybrid of some of the previous best performing ones. We have carried out comprehensive computational campaigns and careful statistical analysis. The results prove that our proposed methods are significantly more effective and efficient than the current state-of-the-art.

**3 - An anticipative scheduling approach with controllable processing times**

Sinan Gürel, Warwick Business School, Warwick University, CV4 7AL, Coventry, United Kingdom, sinan.gurel@wbs.ac.uk, M. Selim Akturk, Ersin Köperoğlu

Preparing machine schedules by considering possible disruption times is critical for rescheduling performance. We consider parallel machine scheduling with controllable processing times. We assume a match-up time strategy such that in case of a disruption a repaired schedule has to catch-up initial schedule at some point. This implies increased manufacturing costs due to decreaed processing times in repaired schedule. We show that making anticipative job sequencing decisions, based on failure and repair time distributions, one can repair a disrupted schedule by incurring less cost.

**4 - Dynamic lead time management**

Müge Muhafluz, Korutürk Mah. Vali Hüseyin Öbütcen Cad. No 19 D3 Balço, 35330, İzmir, mmuhafluz@gmail.com, Arslan Ornek, Selin Özpeynirci, Cemalettin Öztürk, Ogze Oktay, Ufuk Dumanlı

Classical MRP assumes constant lead times, which, in real life, change dynamically depending on the current load of the shop floor. This study presents a mixed integer programming model for production planning and scheduling problem in multi-level, multi-machine structure. We consider the time capacities of machines, due dates, sequence-dependent setup times and precedence relations of operations. The aim is to schedule the operations on a set of eligible machines and determine dynamic lead times of orders such that total earliness and tardiness penalties and idle times are minimized.

**Railway Scheduling**

Stream: Scheduling

**Invited session**

Chair: Syed Hasnain Haider Gilani, Faculty of Information Technology, University of Central Punjab Lahore Pakistan, 31 Main Gulberg Lahore Pakistan, Tele +92-24-5753314-7, 54000, Lahore, Pakistan, syedhasnain_haider@hotmail.com

**1 - Scheduling trains in single-line working**

Francis Sourd, Innovation & Research, SNCF, Paris, France, Francis.sourd@sncf.fr, Christian Weber

On a double track railway, single-line working means that only one track out of two is used, typically because one of the tracks is out of use for maintenance or because of damage or obstruction. We study how to reschedule the trains in order to minimize the impact of the maintenance or of the damage. We show how to model the problem as a theoretical scheduling problem with setup times then we propose a pseudopolynomial algorithm to solve it. We also show how the algorithm is implemented in a tool and how the algorithm can deal with robust solutions or the re-opening of the closed track.

**2 - Rail track inspection scheduling**

Sebastien Lannez, bd Menilmontant, 75011, PARIS, sebastien.lannez@gmail.com, Christian Artigues, Michel Gendreau, Nicolas Marcos

The Rail Track Inspection Scheduling Problem (RTISP) is an arc routing problem with capacity (CARP), time windows (CARP-TW) and an heterogeneous fleet (H-CARP). Long term horizon, graph representation size, and strong needs for a good interactivity between the tool and the user, guided us towards using heuristic methods. A decomposition based on column generation and time slot aggregation is presented and numerically tested on a generated dataset. The impacts of various column generation schemes are detailed.

**3 - Vehicle scheduling for rail freight services**

Hanno Schülldorf, DB Mobility Logistics AG, Stephensonsstr. 1, 60326, Frankfurt, Germany, hanno.schuelldorf@bahn.de

Due to many contributions on this subject, vehicle scheduling seems to be a solved problem. However, additional constraints like maintenance planning and homogeneity make the problem rather hard, especially for large instances. We decompose the problem in three parts which of the first is a min-cost circulation problem; the second part is a min-max-problem under certain constraints, and the third part includes the maintenance planning which we describe as a multicommodity flow problem. Each part can be solved separately, or can be omitted because of other available solutions.
4 - An optimization of multi objective single track train scheduling problem

Syed Hasnain Haider Gilani, Faculty of Information Technology, University of Central Punjab Lahore Pakistan, 31 Main Gulberg Lahore Pakistan, Tele +92-24-5753314-7, 54000, Lahore, Pakistan, syedhasnain_haider@hotmail.com, Syed Muhammad Zaki, Asim Raza, Yasir Imtiaz Khan

Single track train scheduling focused toward finding overall optimal solution of the whole system. Researchers ignored the individual schedule of each train. In this paper the meaning of optimal schedule is redefine. We define sets of stations having predefined priorities. Schedule of each train at each station of a particular set is an objective of our system. First, in this model every train meets its schedule time for those stations that belong to highest priority set than low priority set.

WD-06
Wednesday 12:55-14:15
Koch

GOR Diploma Awards
Stream: GOR-Awards
Invited session
Chair: Stefan Nickel, Institut fuer Operations Research, Universitaet Karlsruhe, Geb 11.40, 76128, Karlsruhe, Baden-Wuertemberg, Germany, Stefan.Nickel@kit.edu
Chair: Alf Kimms, Mercator School of Management, University of Duisburg-Essen, Lotharstr. 65, LB 125, 47057, Duisburg, Germany, alf.kimms@uni-dues.de

1 - Optimization and simulation of traffic flows in the case of evacuating urban areas

Klaus-Christian Maassen, Mercator School of Management, University of Duisburg-Essen, Lotharstrasse 65, 47048, Duisburg, Germany, klaus-christian.maassen@uni-dues.de

When urban areas need to be evacuated, a large number of vehicles must be routed through street networks in such a way that e.g. the total evacuation time is as small as possible. Hence, a traffic routing optimization model has to be solved. However, traffic flows are dynamic in nature so that traffic simulation is required for adequate consideration of such effects. This master thesis presents a two-staged evacuation planning approach that contains optimization and simulation of traffic flows. The applicability to real-world-sized problems is approved for a neighborhood in a german city.

2 - Distance-constrained vehicle routing

Markus Reuther, Optimization, Zuse-Institut Berlin, Takustrasse 7, 14195, Berlin, Germany, reuther@zib.de

The Distance-constrained Vehicle Routing Problem (DVRP) deals with the construction of a minimum length set of tours in a graph, each of bounded individual length, that start from a depot and visit all nodes. We propose lower bounds from a new flow formulation of the DVRP, which is of polynomial size, but implies all subtour elimination constraints. We also show that the Lin-Kernighan heuristic for the TSP can successfully be adapted to solve large scale DVRPs. These techniques are used to solve DVRPs arising in an application at DB Stadtverkehr GmbH.

3 - Branch-and-price algorithms for the traveling tournament problem (tpp)

Ulrich Schrempf, Mauerstr. 60, 52064, Aachen, Germany, ulli.schrempf@gmail.com

The TTP is a sports league scheduling problem. The talk presents a branch-and-price algorithm based on a new compact formulation. The variables of this formulation correspond to arcs in a network. The extensive formulation resulting from Dantzig-Wolfe decomposition is well-structured with a set-partitioning master problem. We identify the pricing problem as a shortest-path problem (SPP) with resource constraints. By expanding the network, it is possible to solve it as an ordinary SPP. Exact techniques allow the elimination of arcs in the network in order to accelerate the algorithm.

WD-07
Wednesday 12:55-14:15
GSI - S 29

Public transportation network design
Stream: Optimization in Public Transport
Invited session
Chair: Leo Kroon, Rotterdam School of Management (RSM), Erasmus University Rotterdam, P.O. Box 1738, 3000 DR, Rotterdam, Netherlands, LKroon@rsm.nl
Chair: Anita Schoebel, Fakultät für Mathematik, Georg-August Universität Göttingen, Lotzestrasse 16-18, 37083, Göttingen, Germany, schoebel@math.uni-goettingen.de

1 - Optimisation of public transportation network configuration and frequency

Hiroshi Shimamoto, Graduate School for International Development and Cooperation, Hiroshima University, 1-5-1, Kagamiyama, Higashi-Hiroshima City, 739-8529, Japan, 739-8529, Higashi Hiroshima, Hiroshima, Japan, shimamoto@hiroshima-u.ac.jp, Fumitaka Kurauchi, Jan-Dirk Schmoecker, Michael Bell

This paper proposes a model for deciding optimal public transport network configuration and frequency considering transferring behaviour. The proposed model is formulated as a bi-level optimisation problem, minimising both the route and frequency of each line. The upper problem is formulated as multi-objective optimisation problem, minimising both passengers’ total travel cost and total operational cost. The lower problem is a capacity-constrained transit assignment model, therefore, it is possible to consider passengers’ route choice behaviour including transferring at some stops.

2 - Designing complementary networks of public transport

Mireia Roca-Riu, CENIT - Centre for Innovation in Transport, C/ Jordi Girona, 29, 2-A, (Building NEXUS II), 08034, Barcelona, Spain, mireia.roca-riu@upc.edu, Miquel Estrada

A bi-level formulation and a methodology based on Tabu Search are studied to solve Bus Network Design problem for Interurban Buses. Public transport among big cities and smaller areas around should be competitive in order to decrease social and user cost. The objective function of the first level is designed to reduce global cost. In the second level, user’s performance is described; an assignment where users choose the best alternative of available ones. Finally, it is applied to two theoretical networks and to Barcelona, where the results show a 5% reduction with regard to present situation.

3 - Link restoration for rapid transit network incidences

Esteve Codina, Statistics and Operational Research, UPC, Edifici C5, Desp 216 Campus Nord, 08034,
Barcelona, Spain, esteve.codina@upc.edu, Ángel Marín

In this work a network design model is proposed for local link restoration in case of complete or partial disruption/malfunction of a Rapid Transit Network. The model must decide the complementary bus services to attend the demand uncovered by the disruption. The model takes into account bus capacity limitations and fleet availability as well as the dwell times of buses at stations. Also, approximations of the waiting time of passengers at stations and the possibility of balking due to excess waiting time are considered in the formulation of the problem

4 - Effectiveness of control strategies for transit line operation

Konstantinos Gkoumas, DITS (Dipartimento di Idraulica Trasporti e Strade), Sapienza Universita’ di Roma, Via Eudossiana 18, 00184, Rome, konstantinos.gkoumas@uniroma1.it, Giuseppe Bellei

The aim of this study is to test the results obtained by applying an integrated conditional priority and vehicle holding strategy to intermediate capacity transit systems. The strategy is tested within the framework of a stochastic operation model, where perturbation formation and diffusion phenomena are duly represented. A simulation model is implemented and the performance of the proposed strategy is evaluated by setting the control parameters at values, determined by a standard probabilistic optimization algorithm, so that the total transit passenger and road user journey time is minimised.

3 - Distribution planning of bulk lubricants at an energy company

M.Furkan Uzar, Industrial Engineering, Sabanci University, Sabanci University OrhanlıTuzla, 34956, Istanbul, mfuzar@su.sabanciuniv.edu, Bilent Catay

We address the distribution planning problem of bulk lubricants at an energy company operating in Turkey. The problem is a multi-product, multi-period, heterogeneous fleet management problem that involves the assignment of customer orders and routing of tank trucks. The objective is to minimize the routing cost and the setup costs associated with the product changeovers. To solve this problem we develop a mixed-integer linear programming model. Since the problem is intractable for real world data we propose a greedy linear programming relaxation-based algorithm and discuss its performance.

WD-09

Wednesday 12:55-14:15
GSI - S 5

Transport Workforce Scheduling II

Stream: Timetabling and Rostering

Invited session

Chair: Willem-Jan van Hoeve, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, 15213, Pittsburgh, PA, vanhoeve@andrew.cmu.edu

1 - Tactical crew planning at Turkish state railways

Birol Yuceoglu, Faculty of Engineering and Natural Sciences, Sabanci University, Orhanlı, 34956, Tuzla, Istanbul, Turkey, biroly@su.sabanciuniv.edu, Gurvem Sahin

Tactical crew planning problem at Turkish State Railways involves finding the minimum crew size to operate a train schedule. The problem is to be solved for each regional crew-base station by satisfying various rules and regulations including a day-off constraint which makes the problem computationally intractable. Mimicking the current practice, we first solve this problem with a sequential approach: a minimum flow problem over a space-time network followed by an assignment problem. Then, we develop an integrated approach by using a layered network representation of the problem.

2 - Truck driver scheduling and regulation (ec) no 561/2006

Asvin Goel, MIT-Zaragoza International Logistics Program, Zaragoza Logistics Center, Avda. Gómez Laguna 25, 1 Planta, 50009, Zaragoza, Spain, asvin@mit.edu

European road transport undertakings must organise the work of truck drivers in a way that drivers are able to comply with driving and working hour restrictions imposed by regulation (EC) No 561/2006. This contribution presents a method for scheduling work weeks of truck drivers which fully considers this regulation for journeys made on roads in the European Union. It is proven that under certain circumstances the approach is guaranteed to succeed in finding a schedule complying with the regulation if such a schedule exists.
3 - Bus driver rostering problem: confronting bi-objective heuristic approaches

Margarida Moz, ISEG, Technical University of Lisbon, Centro de Investigacão Operacional, University of Lisbon, Rua do Queixas nº 6, 1200-781, Lisboa, Portugal; mmoz@iseeg.ule.pt, Margarida Pato, Ana Respicio

The Bus Driver Rostering Problem is to build a roster complying with labour contract rules and company regulations plus covering all timetabled trips of vehicle tours in a specific area. Good rosters are not necessarily considered as such for both company and drivers. The problem is formulated as a bi-objective optimisation problem to minimise salary costs and to equitably distribute overtime work among drivers. Evolutionary heuristic approaches are designed and tested on a set of real-world instances while points from the true Pareto frontier are used to assess the heuristics’ performance.

4 - Domain filtering for the intersection of set variables

Willem-Jan van Hoeve, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, 15213, Pittsburgh, PA, vanhoeve@andrew.cmu.edu, Ashish Sabharwal

Many combinatorial problems can be conveniently expressed using set variables and constraints over these variables. In the context of constraint programming, the structure captured by the set variable representation can be exploited in domain filtering algorithms, and thus facilitate the solution process. We present the first polynomial-time bounds-consistency algorithm for the constraint that forbids the intersection of two set variables to have cardinality larger than one, which can be used, e.g., in sport scheduling applications. Computational results show the effectiveness of our algorithm.

□ WD-11
Wednesday 12:55-14:15
GSI - S 17
PROMETHEE & GAIA: Tutorial
Stream: Multiple Criteria Decision Analysis
Invited session
Chair: Bertrand Mareschal, Solvay Brussels School of Economics and Management, Université Libre de Bruxelles, Boulevard du Triomphe CP 210/01, 1050, Brussels, Belgium, bmares@ulb.ac.be

1 - The promethee & Gaia multicriteria decision aid methods

Bertrand Mareschal, Solvay Brussels School of Economics and Management, Université Libre de Bruxelles, Boulevard du Triomphe CP 210/01, 1050, Brussels, Belgium, bmares@ulb.ac.be, Yves De Smet, Quantin Hayez

The first part of the paper introduces the foundations of the PROMETHEE & GAIA methods. While PROMETHEE is used to rank a set of actions according to several criteria, GAIA provides the decision-maker with a graphical view of the decision problem including information on conflicts to solve and on the impact of the weights of the criteria on the PROMETHEE ranking. We also stress new developments including an original PROMETHEE I partial ranking display and new GAIA-type tools designed to improve the efficiency of the decision-making process and to enhance the link between PROMETHEE and GAIA.

2 - D-sight: a new promethee-based software

Quantin Hayez, SMG - Faculty of Engineering, ULB - Brussels Free University, Boulevard du Triomphe CP210/01, 1050, Brussels, Belgium, qhayez@ulb.ac.be, Yves De Smet, Bertrand Mareschal

D-Sight is a new software that implements the PROMETHEE & GAIA methods, including their newer extensions. It introduces new visual modelling tools and graphical representations of the results of the multicriteria analysis. The interaction with the decision-maker has been emphasized through several sensitivity analysis tools. Numerical examples will be used to illustrate the features of the software.
Stochastic Programming Models

Stream: Stochastic Programming

Invited session

Chair: Rüdiger Schultz, Mathematics, University of Duisburg-Essen, Lotharstr. 65, D-47048, Duisburg, Germany, schultz@math.uni-duisburg.de

1 - A stochastic model for fixed-income securities portfolio selection with transaction costs and default probabilities

Larraitz Aranburu, Economía Aplicada III, UPV-EHU Facultad de Ciencias Económicas y Empresariales, Avda. Lehenbakari Aguirre, 83, 48015, Bilbao, Spain, larraitzaranburu@ehu.es, Laureano Fernando Escudero, M. Araceli Garín, Gloria Pérez, Gloria Pérez

The aim of the stochastic model for fixed-income securities portfolio selection developed in this paper is to construct an immunized portfolio against interest rate changes all over the time. The model also allows the introduction of both transaction costs and different bond ratings, so different default probabilities. Several objective functions are proposed for introducing this risk into the model, so that any investor can reach its optimum portfolio according to its risk averseness. A stochastic model is proposed and some computational experience is reported.

2 - Contamination techniques for mixed stochastic programming problems

Martin Branda, Department of probability and mathematical statistics, Charles University in Prague, Ke Karlovu 3, 121 16, Prague, Czech Republic, martin.branda@seznam.cz

Contamination techniques play an important role in post-analysis of solutions of stochastic programming problems. We consider two special models: two stage stochastic programming problem with mixed probabilities in the second stage and Conditional Value at Risk with mixed-integer loss function. We derive explicit formulas for Gateaux directional derivatives of optimal value functions and propose construction of contamination bounds with respect to underlying distribution. We include numerical study and practical construction of contamination bounds.

3 - Stochastic dominance constraints induced by mixed-integer linear recourse

Rüdiger Schultz, Mathematics, University of Duisburg-Essen, Lotharstr. 65, D-47048, Duisburg, Germany, schultz@math.uni-duisburg.de

We discuss structural properties and algorithms for stochastic programs involving a special type of dominance constraints. The latter concern random variables which are induced by the overall costs in a two-stage stochastic program with mixed-integer linear recourse. In particular, our analysis includes some first stability results and decomposition algorithms.

Competitive location 2

Stream: Location Analysis

Invited session

Chair: Knut Haase, Institut für Wirtschaft und Verkehr, Technische Universität Dresden, Andreas-Schubert-Str. 23, 01062, Dresden, Germany, knut haase@tu-dresden.de

1 - Competitive discrete facility location problem with residual demand and distance threshold

Arifulalam Shaikh, Kent Business School, University of Kent, CT2 7PE, Canterbury, United Kingdom, arifulkupn@yahoo.com, Said Salhi, Malick M. Ndiaye

A competitive discrete location problem is considered. We assume that for an open outlet the total attracted demand is prorated to the level of service. This leaves a residual demand that has to be eventually allocated to other competitors. The decision of such residual customers to select any of the open facilities may depend on trade off between its distances to the next best competitor. A variant of the well known MAXCAP model is introduced to incorporate the distance threshold. A mathematical model as well as a heuristic approach based on GA will be provided and comparative results given.

2 - Simultaneous decisions in competitive discrete location problems

Joana Matos Dias, FEUC / INESC, University of Coimbra, Av. Dias da Silva, 165, 3004-512, Coimbra, joana@fe.uc.pt, Pedro Godinho

In this work, discrete location problems with two decision makers simultaneously deciding where to locate facilities in a competitive environment are studied. Two different situations are considered: the decision makers are able to open facilities at the same location or at most one facility can be open at each location. The links between these problems and the Stackelberg location problems are investigated, as well as links with game theory (namely the existence of Nash equilibrium solutions).

3 - Competitive location models using a threshold-sensitive customer choice rule

Dolores R. Santos-Peñate, Métodos Cuantitativos en Economía y Gestión, Universidad de Las Palmas de Gran Canaria, Campus de Tafira. Edificio Dptal de Ciencias Económicas y Empresariales D-4-22, 35017, Las Palmas de Gran Canaria, Canarias, Spain, drsantos@dlc.ulpgc.es, Rafael Suárez, Pablo Dorta-González

We study a competitive location problem on networks. Goods are assumed to be essential and the customer choice rule represents a threshold-sensitive customer behaviour. Depending on the differences in distance between a customer and the competing firms, the demand is totally captured by only one firm or it is distributed among the competitors. With a customer’s threshold of indifference, this rule modifies the assumption of “all or nothing” behaviour represented by the binary choice rule. The model proposed is analysed and some results are obtained.

4 - Discrete location planning

Knut Haase, Institut für Wirtschaft und Verkehr, Technische Universität Dresden, Andreas-Schubert-Str. 23, 01062, Dresden, Germany, knut haase@tu-dresden.de
Two new models for discrete location planning under static competition are introduced. The probability that a customer chooses a specific store is obtained from a multinomial logit (MNL) model. In the first model we apply the basic MNL model, where we take advantage of the property of constant substitution patterns. In the second model we consider the case where flexible substitution patterns are accounted for. The model is based on the decision behaviour of a large number of simulated individuals.

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**WD-14**

**Wednesday 12:55-14:15**

**GSI - S 32**

**Inventory Management IV**

**Stream: Inventory Management**

**Invited session**

Chair: Baris Balcigil, Mechanical and Industrial Engineering, University of Toronto, 5 King’s College Road, M5S 3G8, Toronto, ON, baris@mie.utoronto.ca

1 - Optimal policy for a capacitated assembly problem

Alexandar Angelus, Operations Management, Singapore Management University, Lee Kong Chian School of Business, 50 Stamford Road, #04-30, 178989, Singapore, Singapore, angelus@smu.edu.sg

We consider a multi-echelon inventory model of an assembly system with limits on production capacities. In the spirit of Rosling (1989), we provide conditions under which system can be reduced to an equivalent capacitated series system. We generalize existing two-echelon results by showing that a capacitated multi-echelon series system achieves the Clark-Scarf decomposition. We find the form of the optimal inventory policy, whose critical thresholds are increasing functions of echelon inventories at upstream stages. A numerical example for a three-echelon system illustrates the results.

2 - Optimal ordering policies with stochastic demand and price processes

Kimitoshi Sato, Nanzan University, d07mm002@nanzan-u.ac.jp, 489-0863, Seto, Japan, d07mm002@nanzan-u.ac.jp, Katsushige Sawaki

Supply Chain risks with respect to product demand and component cost uncertainties are taken quite seriously in various industries. In this paper, we consider a model in which a firm uses the spot market for procurement in order to accomplish the minimization of total discounted costs. The model can be formulated as quasi-variational inequality problem where the demand and spot price follow diffusion stochastic processes. We derive an optimal policy as an (s,S) policy where s and S are uniquely determined as a solution of simultaneous equation.

3 - Modeling multi-echelon inventory systems with several repair modes under non-stationary demands

Yael Perlman, Department of Interdisciplinary Studies, Bar-Ilan University, 6 Dulchin St., 76516, Rehovot, Israel, perlmay@mail.biu.ac.il, Eugene Levner

Consider an inventory system dedicated to serve an aircraft located at several geographically distributed operating locations or bases. We analyze several modes of repair service with different repair times and formulate a network model of the problem which permits to efficiently solve the problem for both stationary and non-stationary demands.

4 - Strategies for a single product m/g/1 multi-class make-to-stock queue

Baris Balcigil, Mechanical and Industrial Engineering, University of Toronto, 5 King’s College Road, M5S 3G8, Toronto, ON, baris@mie.utoronto.ca, Hossein Abouee-Mehrizi, Opher Baron

We consider a centralized production facility that serves distinguishable markets for a single product. We provide the exact analysis of the decentralized priority policy with dispatching decisions postponed to the end of production and the centralized inventory rationing and Strict Priority (SP) policies for general service times. We numerically demonstrate that the centralized inventory rationing policy minimizes costs and that the slightly costlier SP policy and the decentralized priority policy might still be useful due to their simplicity.

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**WD-15**

**Wednesday 12:55-14:15**

**Einstein**

**Fairness in Sports**

**Stream: OR in Sports**

**Invited session**

Chair: Dirk Briskorn, Department for Production and Logistics, University of Kiel, Oldenhusenstrasse 40, 24098, Kiel, Germany, briskorn@bw1.uni-kiel.de

1 - Scheduling sports tournaments on a single court minimizing waiting times

Sigrid Knust, Institute of Mathematics, Technical University of Clausthal, Erzstr. 1, 38678, Clausthal-Zellerfeld, Germany, sigrid@informatik.uni-osnabrueck.de

We consider a single round robin sports tournament, partitioned into rounds, where for every round only a single sports court is available and all teams have to travel to this location. In order to reduce the number of travels, each team is supposed to play twice in each round. The objective is to find a schedule which minimizes the waiting times for the teams. We study two variants in which zero waiting times are allowed or not and construct schedules (based on graph theory) for any odd number of teams minimizing the number of long waiting times and the total waiting time simultaneously.

2 - A study of fairness in fourball golf competition

Patrick Siegbahn, Royal Institute of Technology, Stockholm, SE-11420, Stockholm, Sweden, siegbahn@gmail.com, Donald Hearn

The golf handicap system has been modified and improved over many decades, with a primary emphasis on golf games in which two players compete against each other. However, handicaps are also used when golf is played as a team game with the minimum of the individual scores as the team score. Thus team scores are the minimum of independent random variables. The purpose of this study is to investigate the issue of fairness in the particular team game known as fourball. We present a number of results, both theoretical and computational, when handicaps are used in this manner.

3 - Does the carry-over effect exist?


Dries.Goossens@econ.kuleuven.be, Frits Spieksma, Frits Spieksma

In a round robin tournament, a team i gives a carry-over effect to a team j, if some other team t’s game against i is immediately followed by a game against team j. In some sports, it is assumed that these effects can influence the outcome of the tournament. Indeed, if team i is a very strong team, then its opponent, team t, could be exhausted and discouraged after this game, which could benefit its next opponent, team j. In this work, we measure whether carry-over effects have an influence on the eventual outcome of the highest division of the Belgian soccer league.
We present VC-DomLEM algorithm for induction of decision rules in Variable Consistency Dominance-based Rough Set Approaches (VC-DRSA). These approaches extend DRSA to deal with problems characterized by a considerable amount of inconsistency in the data. We induce preference rules characterized by a controlled degree of consistency. We compare VC-DomLEM with a wide range of learning models and classification methods on real and benchmark data sets. We show benefits from learning with ordinal (multi-criteria) models as opposed to models that ignore information about preference ordering in data.

4 - The classification methods decision tree and PROAFTN: a comparative study

Nabil Belacel, Knowledge discovery group, NRC-Institute for Information Technology-e-Business, 55 Crowley Farm, E1A 7R1, Moncton, New Brunswick, Canada, nabil.belacel@nrc.gc.ca, Feras Al-Obeidat

The objective of this paper is to conduct a comparative and analytical study between two classification methods: the decision tree and the PROAFTN which belongs to the multicriteria decision analysis. We have introduced the PROAFTN method which also has the capability of generating decision rules that can be easily interpreted. This comparative study examines the differences between PROAFTN and the decision tree in terms of their learning methodology, classification accuracy, and interpretability. The experimental results show that PROAFTN method outperforms the decision tree algorithms.

4 - A hybrid heuristic for minimizing weighted carry-over effects in round robin tournaments

Allison Guedes, Universidade Federal Fluminense, 24210240, Brazil, brazil, aguedes@ic.uff.br, Celso Ribeiro

The carry-over effects value is one of the various measures one can consider to assess the quality of a round robin tournament schedule. We introduce and discuss a new, weighted variant of the minimum carry-over effects value problem. The problem is formulated by integer programming and a heuristic based on the hybridization of the Iterated Local Search metaheuristic with a multistart strategy is proposed for its approximate solution. Numerical results are presented.

- Learning intransitive preference relations with regularized least-squares

Willem Waegeman, Department of Applied Mathematics, Biometrics and Process Control, Ghent University, Coupure links 653, 9000, Ghent, willem.waegeman@ugent.be, Tapio Pahikkala, Evgeni Tsivtsivadze, Bernard De Baets, Tapio Salakoski

In different fields it has been observed that (reciprocal) preference relations on humans and animals can be intransitive. We present a kernel-based machine learning algorithm for inferring such relations from paired-comparison data, by extending the existing RankRLS algorithm. It is shown how a joint pairwise feature mapping like the Kronecker-product defines the transition from transitive to intransitive relations. We empirically demonstrate on benchmark problems in game theory and biology that our algorithm outperforms the traditional (transitive) ranking approach.

- Three approaches to ordinal classification

Krzysztof Dembczynski, Institute of Computing Science, Poznan University of Technology, Piotrowo 2, 60-965, Poznan, Poland, kdembczynski@cs.put.poznan.pl, Wojciech Kotowski

We will discuss the nature of ordinal classification, in which a meaningful order between class labels exists. There are two different views on this problem: as a special form of the ranking problem and as an extension of ordinary classification. We will show three approaches to deal with this problem. The first one consists in reducing the problem to a sequence of binary problems. The second one relies on introducing a threshold loss function. The last one is based on rank loss minimization. We will analyze and compare these approaches using different learning algorithms and applications.

- Learning of preference rules in variable consistency dominance-based rough set approaches

Jerzy Błaszczyński, Institute of Computing Science, Poznan University of Technology, ul. Piotrowo 2, 60-965, Poznan, Poland, jurek.blaszczyinski@cs.put.poznan.pl, Salvatore Greco, Roman Slowinski, Marcin Szelag

We present VC-DomLEM algorithm for induction of decision rules in Variable Consistency Dominance-based Rough Set Approaches (VC-DRSA). These approaches extend DRSA to deal with problems characterized by a considerable amount of inconsistency in the data. We induce preference rules characterized by a controlled degree of consistency. We compare VC-DomLEM with a wide range of learning models and classification methods on real and benchmark data sets. We show benefits from learning with ordinal (multi-criteria) models as opposed to models that ignore information about preference ordering in data.

4 - The classification methods decision tree and PROAFTN: a comparative study

Nabil Belacel, Knowledge discovery group, NRC-Institute for Information Technology-e-Business, 55 Crowley Farm, E1A 7R1, Moncton, New Brunswick, Canada, nabil.belacel@nrc.gc.ca, Feras Al-Obeidat

The objective of this paper is to conduct a comparative and analytical study between two classification methods: the decision tree and the PROAFTN which belongs to the multicriteria decision analysis. We have introduced the PROAFTN method which also has the capability of generating decision rules that can be easily interpreted. This comparative study examines the differences between PROAFTN and the decision tree in terms of their learning methodology, classification accuracy, and interpretability. The experimental results show that PROAFTN method outperforms the decision tree algorithms.
Today, memories embedded in electronic chips are tested after production with the help of additional dedicated circuitry, a methodology known as ‘memory-BIST’. Until recently, testing was done using one BIST design block for each memory on chip. The increase of the number of memories calls for sharing BIST circuitry among memories, while keeping watch on three parameters: testing time, testing power, and additional dedicated surface.

A model for this real-world, multi-objective optimization problem will be given, and approaches for an algorithmic solution will be presented. We study the problem of inferring the traffic on each Origin-Destination pair of a large network. The aim is to optimize the use of network-monitoring tools; to this end, we formulate a combinatorial optimization problem, whose objective is to find the “best” subset of measurements which should be performed. The experimental design approach consists in minimizing the variance of a certain estimator of the flows. We show that this problem can be solved very efficiently by Second Order Cone Programming, and we present experimental results comparing our method with previously proposed ones.

3 - The coolest path problem
Armin Fügenschuh, Optimierung, Zuse Institut Berlin, Takustraße 7, 14195, Berlin, Germany, armin.fuegenschuh@googlemail.com, Martin Frank, Michael Herty, Lars Schewe

We introduce the coolest path problem, which is a mixture of two problems from distinct mathematical fields: The shortest path problem from combinatorial optimization and the heat conduction problem from the field of partial differential equations. Together, they make up a control problem, where some geometrical object traverses a digraph in an optimal way, with constraints on intermediate or the final state. We discuss some properties of the problem and demonstrate that it can be formulated as a linear mixed-integer program. Numerical results are presented.

WD-18
Wednesday 12:55-14:15
Lenné

Mathematical Programming in Networks 1
Stream: Mathematical Programming
Contributed session
Chair: Armin Fügenschuh, Optimierung, Zuse Institut Berlin, Takustraße 7, 14195, Berlin, Germany, armin.fuegenschuh@googlemail.com
Chair: Gerhard-Wilhelm Weber, Institute of Applied Mathematics, Middle East Technical University, ODTÜ, 06531, Ankara, Turkey, gweber@metu.edu.tr

1 - Piecewise linear approximation methods for the layout optimization in recovered paper production
Christine Hayn, Department of Mathematics, TU Darmstadt, Schlossgartenstr. 7, 64289, Darmstadt, Germany, hayn@mathematik.tu-darmstadt.de, Armin Fügenschuh

An MINLP model for the simultaneous optimization of process variables and machine layout in recovered paper production is presented. For solving the model the nonlinear nonconvex functions occurring are approximated by piecewise linear ones, either directly or after transformation to separable functions. Several techniques for incorporating piecewise linear functions in an MILP are compared computationally using Cplex, Scip and Cbc. The results are furthermore compared to those obtained using the NLP solver Ipopt as well as the MINLP solvers Baron and Bonmin directly for the nonlinear models.

2 - Experimental design techniques applied to the measurement of traffic in large networks
Guillaume Sagnol, CMAP, INRIA Saclay, CMAP Ecole Polytechnique, Route de Saclay, 91128, Palaiseau, France, guillaume.sagnol@inria.fr, Mustapha Bouhtou, Stéphane Gaubert

In this paper, the cover printing problem, which consists in the grouping of book covers on offset plates in order to minimize the total production cost, is discussed. As the considered problem is hard, we discuss and propose a greedy random adaptive search procedure (GRASP) to solve the problem. The quality of the proposed procedure is tested on a set of reference instances, comparing the obtained results with those found in the literature. Our procedure improves the best known solutions for some of these instances. Results are also presented for larger, randomly generated problems.
This paper proposes a new metaheuristic, called Self-Regulated Multiple Simulated Annealing (SRM-SA). Its main advantage is not to require SA’s parameters values to be entered by an user, because SRM-SA works with a population of solution containers, and their own costs are used to regulate their temperatures. Only population size remains as an external parameter. Also, SRM-SA explores solutions space as widely as possible: a non-convergent approach, unlike SA, GA and others. In tests over Set Covering Problem, SRM-SA’s implementation has reached the best results known for each instance.

■ WD-20
Wednesday 12:55-14:15
Mann

DEA Applications III
Stream: DEA and Performance Measurement
Invited session
Chair: Heinz Ahn, Institut für Controlling und Unternehmensrechnung, TU Braunschweig, Pockelsstr. 14, 38106, Braunschweig, Germany, hw.ahn@tu-bs.de

1 - DEA software evaluation and development
Kersten Hentrich, Lehrstuhl f. Controlling u. Unternehmensrechnung, TU Braunschweig, Pockelsstr. 14, 38106, Braunschweig, khenrich@gmx.de, Heinz Ahn

Based on the so-called requirements engineering approach, commercial and non-commercial DEA software is compared by means of over 60 criteria. Within this evaluation, different types of stakeholders are taken into account. On one hand, the approach gives insight into the stakeholder-oriented strengths and weaknesses of common DEA software. On the other hand, it provides a framework for customized DEA software development.

2 - New features and capabilities of data envelopment analysis online software (deaos)
Mohammad Reza Aliрезaezее, School of Mathematics, Iran University of Science and Technology, Hengam St., Resalat Sq., 16846, Tehran, Iran, Islamic Republic Of, mralirez@yahoo.com, Ali Niknejad, Nassrin Alirezaee

As the field of DEA has grown and blossomed, so have the varieties of models, data, and types of analysis, similarly, as DEA software technology has to emerge. DEAOs could present as professional web application including several available models, useful features, user friendly interface and reporting, importing data, exporting results and easy to use on internet. Here the new features and capabilities, added to DEAOs, including advance models, trade-off analysis, and many other items will be presented. DEAOs is available at www.DEAOs.com.

3 - Performance improvement management software for the advanced user
Ali Emrouznejad, Aston Business School, Aston University, B4 7ET, Birmingham, United Kingdom, a.emrouznejad@aston.ac.uk, Emmanuel Thanassoulis

This paper presents software that takes its features closer to the latest developments in the DEA literature. The new software addresses a variety of issues such as: Assessments under a variety of possible assumptions of returns to scale including NIRS and NDRS; truly unlimited number of assessment units (DMUs); Analysis of groups of data by estimating automatically separate boundaries by group; Malmquist Index and its decompositions; Super efficiency; Automated removal of super-efficient outliers under user-specified criteria; Cross efficiency; Bootstrapping.

4 - Evaluation of school of law efficiency in Turkey by using data envelopment analysis
Ezhan Berk, Hava Durgi Lojmanlari 4.Blok Daire:1, 06790, ANKARA, Turkey, eberk@kho.edu.tr

Countries become prominent in economy and policy with their human resources in the global world. Universities are one of the important phases in this human resource growth process. School of law in universities has an important role in educating people that have effect in mass communities. This study focused on the efficiency of law schools in Turkey. Efficient virtual reference values have been found for the inefficient decision units. Factor results that has to be for the reference units have been determined. In the light of the results, public and private schools were compared.

■ WD-21
Wednesday 12:55-14:15
Hauptmann

Theory of Boolean Functions
Stream: Boolean Programming
Invited session
Chair: Gyorgy Turan, Math., Stat. and Comp. Sci., Univ. of Illinois at Chicago, 851 S.Morgan, M/C 249, 60608-7045, Chicago, IL, United States, gyt@uic.edu

1 - The complexity of sign matrices
Hans Simon, Department of Mathematics, Ruhr-University Bochum, 44780 Bochum, 44780, Bochum, NRW, hans.simon@rub.de

Sign matrices represent distributed Boolean functions. In the last decade, there has been a growing interest in complexity measures for sign matrices that can be bounded from above or below by algebraic methods. In this talk, we discuss some relations between these measures and mention some connections to learning theory.

2 - Nondisjoint decompositions of boolean functions
Jan Corstiaan Bioch, Dept. of Computer Science, Erasmus University Rotterdam, FEW, H10-30, PO BOX 1738, 3000DR, Rotterdam, Netherlands, bioch@few.eur.nl

We discuss nondisjoint decompositions of a Boolean function f of the form f =F(A,B,g(B,C)), where A,B and C are disjoint sets of variables. If B is the empty set then the theory of decompositions, studied in game theory, reliability theory etc., is well understood. However, in the general case little or nothing is known. We present some results on the lattice of components g of f for a fixed partition A,B and C, and we generalize the famous three modules theorem.

3 - Statistical query learning and strong sq dimension for some formula classes
Balazs Szorenyi, Lehrstuhl Mathematik & Informatik, Ruhr-Universität Bochum, Universitätstraße 150, D-44801, Bochum, Germany, szorenyi@inf.u-szeged.hu

In statistical query learning we have some distribution and a Boolean function class fixed, and want to find some function having high correlation with some unknown element f of the class. We cannot access f directly, but can measure (query) its correlation with any function–up to some accuracy. Simon has introduced and shown the notion of strong SQ dimension to be polynomially related to the minimal number of queries needed. In this talk we further investigate this notion and give bounds for its value for some specific classes like conjunctions, monotone conjunctions and read-once DNFs.
4 - A restricted boolean consensus method for the transitive closure of a digraph

Bruno Simeone, Dept. of Statistics, University of Rome La Sapienza, Piazzale Aldo Moro 5, 00185, Rome, Italy, bruno.simeone@uniroma1.it, Endre Boros, Stephanie Foldes, Peter L. Hammer

The classical Consensus method generates all prime implicants of a Boolean function. Restricted versions, e.g. the disengagement and the input consensus ones, are also known. We present a combination of the latter two, resulting in a new and fast algorithm for the transitive closure of digraphs, which works for suitable arc scanning orders. We give characterizations of "good" orders in digraphs, and show how to get one such order in arbitrary digraphs. The problem of finding the smallest number of input arcs that generate the transitive closure in directed trees is also solved.

■ WD-22

Wednesday 12:55-14:15

Arndt

AHP V


Invited session

Chair: Coskun Hamzaçebi, Business Administration, Z. Karaelmas University, Incizev, 67100, Zonguldak, Turkey, coskunh@karaelmas.edu.tr

1 - Stock selection in food sector

Coskun Hamzaçebi, Business Administration, Z. Karaelmas University, Incizev, 67100, Zonguldak, Turkey, coskunh@karaelmas.edu.tr, Sedat Erdogan

The people and firms compose their investments according to the risk and return. An applicable method is to give investment decisions according to the firms’ financial ratios such as productivity, profitability, efficiency, indebtedness, liquidity. In this study, the usage of MCDM techniques in food sector stock investments is examined. The firms were selected from Istanbul Stock Exchange. AHP and TOPSIS techniques were used as MCDM tool. Found results were compared with actual ranking of stocks. Finally, the accuracy of such selection is examined.

2 - Application of AHP and fuzzy multicriteria linear programming in selecting suppliers and determining purchasing quotas

Tunjo Peric, Pekarne Sunce d.o.o., Rakitje, Rakitska cesta 98, 10437, Bestovije, Croatia, tunjo.peric1@zg-t-com.hr, Zoran Babic

This paper investigates the problem of supplier selection and determination of flour purchasing quotas for a bakery. In addition to the purchasing cost as the basic criterion the authors also take the quality of flour and supplier reliability as the relevant criteria. To evaluate suppliers according to the adopted criteria they use the AHP method, while the purchasing quotas are determined by use of fuzzy linear programming. In the end they perform sensitivity analysis of the presented model by testing the effect of changes in criteria priorities on the final evaluation of suppliers.

■ WD-23

Wednesday 12:55-14:15

Planck

Distributed DSS

Stream: Decision Support Systems

Invited session

Chair: Pascale Zaraté, Institut de Recherche en Informatique de Toulouse, 118 route de Narbonne, 31062, Toulouse, France, zarat@irit.fr

1 - A multi-agent framework for a web dss applied to manufacturing system

Taghezout Noria, Computer Science Department, University of Es-Senia Oran, BP 1524 El-M’Naouer, 31000, Oran, Algeria, taghezoutnour@yahoo.fr

Combination of Web services and software agents provides a promising computing paradigm for efficient service selection and integration of inter-organizational business processes. This paper proposes an agent-based Web DSS; the main contribution of our study is to provide an efficient tool that helps users find information resources available as an online service within an Intranet. In order to solve conflicts, Integrated Station of Production (ISP) agents use Web service to conduct various complementary tasks.

2 - Participating in competitive online games: analyzing competitive and hedonic decision elements

Thomas Weiss, Dept. of Business, Media and Technology Management, University of Cologne, Pohligstr. 1, 50969, Koeln, thomas.weiss@uni-koeln.de, Claudia Loebbecke

Competitive online gaming has been a major engine of the rapidly growing online game market in recent years. Its market success depends on the acceptance and use of such games. So far, only few studies have investigated related players’ decisions. To fill this gap, based on the Uses and Gratifications approach (Rosengren 1974), this paper analyzes players’ decisions to participate in competitive online games combining competitive and hedonic aspects.

3 - Distributed decision making goes multiscale

Christian Wernz, Grad Department of Industrial and Systems Engineering, Virginia Tech, 250 Durham Hall, Virginia Tech, 24061, Blacksburg, VA, United States, wernz@vt.edu

Decision makers (DMs) in business organizations should make decisions taking into account their influence on other DMs, and the effect of other DMs on them. The mutual influence occurs across various hierarchical levels, or scales. We develop a multiscale decision making model — based on distributed decision making and game theory — which provides analytical results guiding hierarchically interacting DMs. Furthermore, our model lays the foundation for a comprehensive multiscale decision making framework which integrates the organizational, temporal and informational scales.

■ WD-24

Wednesday 12:55-14:15

GSI - S 20

Convex programming and applications

Stream: Nonlinear Programming

Invited session

Chair: Domingos Cardoso, Departamento de Matematica, Universidade de Aveiro, Campus Universitario de Santiago, 3810-193, Aveiro, Portugal, dcardoso@ua.pt
1 - Truncated codifferential method for nonsmooth convex optimization

Adil Bagirov, School of Information Technology & Mathematical Sciences, University of Ballarat, University Drive, Mount Helen, P.O. Box 663, 3353, Ballarat, Victoria, Australia, a.bagirov@ballarat.edu.au, Ali Hakan Tor

In this paper a new algorithm to minimize convex functions is developed. This algorithm is based on the concept of codifferential. Since the computation of whole codifferential is not always possible we propose an algorithm for computation of descent directions using only a few elements from the codifferential. The convergence of the proposed minimization algorithm is studied and results of numerical experiments using a set of test problems with convex objective function are presented. We also compare the new algorithm with the bundle method using the results of numerical experiments.

2 - Recente results on graphs with convex quadratic stability number

Maria F Pacheco, Instituto Politécnico de Bragança - ETR, Quinta de Santa Apolónia, Gal. 112, 5301-857, Bragança, Portugal, pacheco@ipb.pt, Domingos Cardoso

The main results about graphs with convex quadratic stability number (that is, graphs for which the stability number can be determined by convex quadratic programming) are surveyed including the most recently obtained. Furthermore, a few algorithmic techniques for the recognition of this type of graphs in particular families are presented.

3 - An upper bound on the 2-club number of a graph

Carlos J. Luz, Math, Escola Sup. Tecnologia Setúbal / Instituto Politécnico de Setúbal, Campus do IPS, Estefanilha, 2910-761, Setúbal, Portugal, cluz@est.ips.pt

A 2-club of a graph is a subset of nodes that induces a subgraph of diameter 2. This communication deals with the maximum 2-club problem which consists on finding a maximum 2-club in an undirected given graph. The cardinality of a maximum 2-club of a graph is usually called the 2-club number of that graph. We first present a convex quadratic programming upper bound for the 2-club number of a graph. Then, we state a sufficient condition for a graph to attain the proposed upper bound. Finally, we improve the offered upper bound and report on its application to several graphs.

1 - The maximum and the addition of assignment games

Silvia Miquel, C/ Jaume II 73, 25001, Lleida, smiquel@matematica.udl.cat, Marina Nunez

Shapley and Shubik (1972) define assignment games as cooperative TU games for two-sided markets. Here, we consider a finite set of assignment games and each set of players can choose to play in one of those games. This is represented by the maximum of assignment games and a balancedness condition is obtained. We also consider that each set of players can play simultaneously more than one assignment game and then add the profits. This is represented by the sum of assignment games which is balanced. Under some conditions, the core of the sum game coincides with the sum of the cores.

2 - Cooperation in stochastic inventory models with continuous review

Judith Timmer, Dept. of Applied Mathematics, University of Twente, P.O. Box 217, 7500 AE, Enschede, Netherlands, j.b.timmer@utwente.nl

We study the inventory management of multiple firms facing stochastic demand. All inventories are monitored continuously. Firms may form a coalition and place joint orders for replenishment of their inventories. In particular, as soon as one firm reaches its reorder point all other firms in the coalition join this firm and order up to their desired inventory levels. The corresponding cost game is studied for properties and nice solutions. Analytical studies show that the game is concave and balanced. Hence, the Shapley value is a natural candidate for cost allocation among the firms.

3 - Inventory transportation networks: benefits by collaboration

Ana Mecca, Operations Research Center, Universidad Miguel Hernández, Avda. Universidad s/n, Edificio Torretemarit, 03202, Elche, Alicante, Spain, ana.mecca@umh.es, Mª Gloria Fiestras-Janeiro, Ignacio García-Jurado, Manuel Alfredo Mosquera Rodríguez

The aim of this talk is to study inventory situations where transportation costs are different for each agent. The underlying allocation cost problem is analyzed by defining a class of cooperative TU cost games. We characterize the situations for which cooperation is profitable and propose some allocations of the total cost. One of these allocation is obtained “à la Shapley” by computing the average of some marginal costs which belong to the core. We provide a characterization of this rule using properties as E-Balanced Contribution (EBC), Extreme agent solidarity (EAS), and E-Transfer (ETR).
It is usual for lot-sizing to use the classical methods for each of the products. Lot sizing in each level of MRP and for each product without considering sub assemblies would have some consequences such as total system costs increasing, lead time increasing and resources shortage. This paper represents a model which can decrease the inventory total system cost. The proposed mathematical model is a nonlinear programming which is solved with a heuristic algorithm. At last, with a numerical example the result of the presented model solution has compared with the other lot-sizing methods and models.

2 - Mip-based heuristics for capacitated lot-sizing with sequence-dependent setups and substitutions

Jan Christian Lang. Chair of Operations Research, Department of Law, Business and Economics, Technische Universität Darmstadt, Germany, Hochschulstr. 1, 64289, Darmstadt, Germany, jclang@bwl.tu-darmstadt.de

We consider a capacitated single-level dynamic lot-sizing problem with sequence-dependent setup costs and times that includes product substitution options. The model is motivated from a real-world production planning problem at a manufacturer of plastic sheets used as an interlayer in car windshields. We develop a mixed-integer programming (MIP) formulation of the problem and outline MIP-based Relax&Fix as well as Fix&Optimize heuristics. Computational experiments with generated instances indicate that Fix&Optimize variants with a time-oriented decomposition perform best.

3 - Heuristics for the multi-item capacitated lot-sizing with lost sales

Nabil Absi, Ecole des Mines de Saint-Etienne, EMSE - CMP - Site Georges Charpak, 880 route de Mimet, 13541, GARDANNE, absi@emse.fr, Boris Detienne, Stéphane Dauzere-peres

In this work we address the multi-item capacitated lot-sizing problem with lost sales. Demand cannot be backlogged, but can be totally or partially lost. This problem is NP-hard. We propose different mathematical formulations. To find a near optimal solution, different heuristic approaches are developed. They are mainly based on a Lagrangian relaxation of the resource capacity constraints. Computational results will be presented in order to compare our approaches to monolithic resolutions of the proposed models using a commercial solver.

Automated storage and retrieval systems (AS/RS) and automated vehicle storage and retrieval systems (AVS/RS) are two competing technologies that have been used extensively for unit-load handling and storage/retrieval in the reserve area of an automated warehouse. We model variants of the two systems as an open queueing network model and analyze them using an existing tool for OQNs called the manufacturing system performance analyzer (MPA). Experimental results with MPA are provided to show that the OQN methodology can be applied effectively to analyze AS/RS and AVS/RS.

2 - Design insights for an autonomous vehicles-based storage and retrieval system

Ananth Krishnamurthy, Industrial and Systems Engineering, University of Wisconsin-Madison, 3258, 1513 University Avenue, 53706, Madison, WI, United States, ananth@engr.wisc.edu, Debjit Roy, Sunderesh Heragu, Charles Malmborg

Autonomous Vehicle based Storage and Retrieval System (AVS/RS) is an alternative to crane-based AS/RS. In AVS/RS, the transaction cycle time is composed of the waiting time for vehicles and lifts, horizontal and vertical travel times, and load/unload times. We investigate how decisions such as tier configuration, dwell point policies and vehicle assignment influence the average cycle time to process transactions. We model the system as a multi-class semi-open queueing network model with class switching and develop a decomposition approach to evaluate system performance and obtain insights.

3 - Shared storage assignment policy in a compact storage system

Nima Zaerpour, Department of Management of Technology and Innovation, RSM Erasmus University, Rotterdam School of Management (RSM), Erasmus University Rotterdam Department of Management of Technology and Innovation, P.O. Box 1738, 3000 DR, Rotterdam, Netherlands, nzzaerpour@rsm.nl, Yugang Yu, René de Koster

This paper studies how to store pallets in a compact storage system in order to minimize the makespan for retrieving pallets. The system stores pallets multi deep. In practice, dedicated storage is commonly used; every storage lane in the system stores only one product type to avoid reshuffling. This paper proposes a mathematical model considering a shared storage policy. The policy allows different product types to share the same lanes. A heuristic algorithm is proposed which can solve large-scale problems. Our results show that the shared storage policy can outperform dedicated storage.

WD-27

Wednesday 12:55-14:15

GSI - S 21

Analytical Models in Facilities Logistics

Stream: Facility Logistics

Invited session

Chair: Sunderesh Heragu, Industrial Engineering, University of Louisville, 200, JB Speed Building, 40292, Louisville, KY, United States, s.heragu@louisville.edu

1 - Analytical models for automated warehouses

Sunderesh Heragu, Industrial Engineering, University of Louisville, 200, JB Speed Building, 40292, Louisville, KY, United States, s.heragu@louisville.edu, Cai Xiao, Ananth Krishnamurthy, Charles Malmborg

WD-28

Wednesday 12:55-14:15

GSI - S 1

Economic Lot Scheduling Problem

Stream: Economic Lot Scheduling Problem

Invited session

Chair: Erik van der Sluis, Quantitative Economics, University of Amsterdam, Roetersstraat 11, 1018 WB, Amsterdam, Netherlands, H.J.vanderSluis@uva.nl

1 - Big-bucket lotsizing problems with synchronization

Christian Almeder, Department of Business Administration, University of Vienna, Brünnerstrasse 72, 1210, Vienna, Austria, Christian.Almeder@univie.ac.at, Bernardo Almada-Lobo
Small-bucket models consider lotsizing and scheduling decisions simultaneously. However, they are difficult to solve, because the period-length is mainly determined by the smallest possible lot. Big-bucket models determine lots but postpone the scheduling decisions to a subsequent planning step. For some applications there are interdependencies between different operations/resources, such that the result of a big-bucket model is not implementable as the remaining scheduling problem is infeasible. We present a formulation which considers such interdependencies within a big-bucket model.

2 - Capacitated lotsizing and scheduling with non triangular sequence-dependent setup times and costs

Bernardo Almada-Lobo, Industrial Engineering and Management, Faculty of Engineering of Porto University, Rua Dr. Roberto Frias s/n DEIG, 4200-465, Porto, Portugal, almada.lobo@fe.up.pt, Alistair Clark

In production planning, sequence dependent setups are often incurred for product switchovers. When setups do not respect the triangular inequality, the optimal solution may include more than one batch of the same product in a single period. By allowing setup crossovers, flexibility is increased and better solutions can be found. In tight capacity conditions, or whenever setup times are significant, setup crossovers are needed to assure feasibility. We present an extension for the capacitated lotsizing and scheduling problem incorporating the features of sequence sub tours and setup crossovers.

3 - A heuristic to solve the economic lot scheduling problem even when there is a high utilization of the facility

Erik van der Sluis, Quantitative Economics, University of Amsterdam, Roetersstraat 11, 1018 WB, Amsterdam, Netherlands, H.J.vanderSluis@uva.nl, Anders Segerstedt

Here we present a heuristic that starts with the common cycle solution finding an optimal time interval for the common frequencies; thereafter in ‘powers of two’ try to reduce or increase the frequency for one item at a time, find the right and lowest possible inventory holding costs (for these different frequencies); and continue in this way until no better solution is found. This heuristic can also be combined with costs for operating the production facility depending on the number of hours the facility is operating per working day.

2 - Epistemic uncertainties in climate predictions: a challenge for epistemology and ethics

Rafaela Hillerbrand, RWTH Aachen, 52056, Aachen, Germany, rafaela.hillerbrand@gmail.com

While the vast majority of experts agrees on the reality of an anthropogenic climate change, few and far between sceptics demur that this consensus only rests upon highly uncertain information obtained from numerical models. Granted, but prognoses on the future climate will always remain uncertain. This paper addresses both questions, the former, epistemological one that resides with philosophy of science, and the later, normative question belonging to the realm of ethics.

3 - Measuring efficiency in complex energy systems

Bo Hu, Universität der Bundeswehr München, 85577, Neubiberg München, Germany, bo.hu@uniwb.de

The author presents a new model which simulates efficiency measures in complex energy models. The impact on the price mechanism in these new (emission trading) markets should be analysed. The ethical dimension of “cap and trade” principles in general should be discussed. As a result, criteria for a fair trade of emission certificates will be derived. The author intends to present first results of an agent based approach for the simulation of such a specific situation.

4 - Distributive impacts of technological flexibility — an application of environmental system modeling

Michael Lueken, Research Domain Sustainable Solutions, Potsdam Institute for Climate Impact Research, P.O. Box 60 12 03, 14412, Potsdam, Germany, lueken@pik-potsdam.de, Nico Bauer, Brigitte Knopf, Marian Leimbach, Otmar Edenhofer

Climate change mitigation will lead to significant welfare redistributions among world regions. We analyze the mechanisms behind regional mitigation costs, focusing on the linkages between the availability of low-carbon energy technologies and the initial allocation of emission permits, which are crucial factors for the regional cost distribution. We apply the multi-regional integrated assessment model REMIND-R, which couples an economic growth model with an energy system model and a simple climate model, and includes inter-regional interactions via trade flows, using the Negishi-approach.

■ WD-29
Wednesday 12:55-14:15
GSI - S 2

Energy Models and Ethical Implications

Stream: Energy and Emission Markets

Invited session

Chair: Michael Lueken, Research Domain Sustainable Solutions, Potsdam Institute for Climate Impact Research, P.O. Box 60 12 03, 14412, Potsdam, Germany, lueken@pik-potsdam.de

1 - Analysis of emission trading markets with system dynamics

Stefan Pickl, Department for Computer Science, Universität der Bundeswehr München, heisenbergstr. 39, 85577, Neubiberg-München, Bavaria, Germany, stefan.pickl@uniwb.de

The authors present a new approach applying system dynamics techniques to the analysis of emission trading markets. Economic aspects are as well reflected as ethical implications. The role of efficiency measures is discussed in detail.

■ WD-30
Wednesday 12:55-14:15
GSI - S 26

Applications of nonsmooth optimization techniques

Stream: Nonsmooth Optimization and its Applications

Invited session

Chair: Julien Ugon, CIAO, University of Ballarat, P.O. Box 663, 3350, Ballarat, Victoria, j.ugon@ballarat.edu.au

1 - Conic functions in classification problems

Gurkan Ozturk, Industrial Engineering, Anadolu University, AU-MMF-Industrial Engineering, Iki Eylul Campus, 26480, Eksisehir, Turkey, gurkan.o@anadolu.edu.tr, Refail Kasimbeyli
Polyhedral conic functions have recently been presented and used to solve classification problems in the frame of mathematical programming approach. Polyhedral conic functions are obtained by augmenting the linear functions with 1 norm. Level set of this functions is a convex polyhedral set and it separates the space to two parts as inside and outside of this level set. In this study, we generalize this approach by using different norms. The classification algorithms obtained by this way are tested on real world dataset and results are discussed.

2 - Multiobjective portfolio optimization problem and solution methods

Ozden Ustun, Department of Industrial Engineering, Dumlupinar University, The Central Campus, 43100, Kütahya, oустun@dpi.edu.tr, Retail Kastimbeylı

In this study, we propose a three-stage integrated approach which combines various forecasts, the conic scalarization method and the modified subgradient algorithm based on feasible values (F-MSG) to solve the extended mean-variance-skewness model for portfolio optimization. The integrated approach is applied to Istanbul Stock Exchange data. The comparison is conducted with respect to different levels of investor preferences over return, variance, and skewness and the obtained results are discussed.

3 - Applying nonsmooth optimization to analyse nonsmooth sleep signals

Nadezda Sukhorukova, CIAO, University of Ballarat, P.O. Box 663, 3350, Ballarat, Victoria, n.sukhorukova@ballarat.edu.au

The problem of sleep stage identification plays a key role in sleep research, including sleep disorder diagnostics. At present, there is no automatic technique which is able to identify sleep stages with a level of accuracy satisfactory to doctors. One of the reasons why this problem cannot be solved accurately enough is its dimension. In our study we suggest an optimisation based technique which allows one to considerably reduce the dimension of the corresponding problems.

4 - A novel piecewise linear classifier based on polyhedral conic and max-min separabilities

Julien Ugon, CIAO, University of Ballarat, P.O. Box 663, 3350, Ballarat, Victoria, j.ugon@ballarat.edu.au, Adil Bagirov

An algorithm for finding piecewise linear boundaries between pattern classes is proposed. This algorithm consists of two main stages. First a polyhedral conic set is used to identify data points close to the boundary. Then a piecewise linear boundary is computed incrementally starting with one hyperplane using only those data points. This approach allows one to reduce the computational effort. Numerical results demonstrate that this algorithm requires a reasonable training time and it consistently produces a good test set accuracy on most data sets compared with other mainstream classifiers.

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**WD-31**

**Wednesday 12:55-14:15**

**GSI - S 34**

**Various Topics on Data Mining and Decision Making**

Stream: Data Mining and Decision Making

*Invited session*

Chair: Christophe Mues, School of Management, University of Southampton, SO17 1BJ, Southampton, United Kingdom, C.Mues@soton.ac.uk

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1. **Corba objects to implement ai agents**

Yaici Malika, computer, university of bejaia, 36, Cité zerara, 06000, bejaia, Algeria, yaici_m@hotmail.com

Many environments were proposed to facilitate development of distributed applications. Currently, among dominant technologies is CORBA. This model proves to be a support system for many emergent fields such as Distributed Artificial Intelligence which propose the concept of agents and Multi-agents. The idea is to use a corba object to design and implement an agent. An agent is characterized by autonomy, socialiability and reactivity, and so can be designed an object. We developed a Chess Game which consisted on a two player agents (corba objects), and on an intelligent help agent (corba object).

2. **Virtual web services**

Hassina Talantikite, department of computer science, university of bejaia, universite de bejaia, departement d’informatique, targa ouzamour, 06000, bejaia, sino_nacer@yahoo.fr, Djamil Aissani

Web services Discovery rely on the facilities offered by the providers in describing the functionalities of their services semantically and on the description of the client’s requests. We propose a model of Semantic Annotations for Web Services which can find several services satisfying the client’s needs. But the client must choose one according to his profile and web services conditions. This technique takes advantages from artificial intelligence and knowledge management. We illustrate the robustness and the efficiency of our proposed approach by the prototype implemented in java.

3. **Towards conflict resolution in agent systems**

Jair Minoro Abe, Paulista University, Rua Dr Bacelar 1212, 04026-002, Sao Paulo, SP, Brazil, jairabe@uol.com.br, Fábio Romeu de Carvalho

Agents’ conflicts arise for different reasons and involve different concepts. Conflicts can be expressed as mere differences or as logical contradictions. Since more and more concern is attached to agents’ teamwork and agents’ dialogue, conflicts naturally arise as a key issue to be dealt with, not only with application dedicated techniques, but also with more formal and generic tools. In this work we propose a logical framework for conflicting knowledge based on the so-called paraconsistent logics which can deal with inconsistency and para completeness in a non-trivial manner.
As a large part of the 45500 German GmbHs are small and medium sized entities, a considerable amount of the operating income of these corporations is required for the shareholders’ livelihood. Hence, it is a major challenge to minimize the taxation on the transfer of income from the corporation to the shareholders. We introduce a mixed-integer linear program that determines a combination of the transfer possibilities which minimizes the total taxation and hence maximizes the transfer to the shareholders. We also present a computational analysis, deriving first insights into the problem.

2 - Optimization of public co-financing of investment projects under crisis circumstances

Vadim Arkin, Central Economics and Mathematics Institute, Nakhimovskii prospekt, 47, 117418, Moscow, Russian Federation, arkin@emi.rssi.ru, Aleksandr Slastnikov

During a period of crisis, participation of the State in financial support of major business projects increases. We propose a stochastic model for studying potentialities of public-private partnership in financing of investment projects for the creation of new enterprises. The model is based on a combination of real options and game theory approaches. We derive explicitly the Stackelberg equilibrium for the game “investor-government”, which characterizes an optimal share of public co-financing in investment project.

3 - Consolidated government-sector budget identity and total seignorage.

Zlatica Ivaničová, Operations Research and Econometrics, FHI EU Bratislava, 85235, Bratislava, Slovakia, zivanicova@hotmail.com

The budget identities of the Treasury and the Central Bank can be combined to produce the consolidated government-sector budget identity. This identity describes that government purchases plus its payment of interest on outstanding privately held debt must by founded by revenues generated by taxes (other as inflation), by borrowing from private sector and printing currency. Divided the above-mentioned values by the price level and real output is possible to separate seignorage revenue.

4 - Employees’ provident fund (epf) of singapore, malaysia, india and sri lanka: a comparative study

Siti Aida Sheikh Hussin, The Centre for the Analysis of Risk and Optimisation Modelling Applications, Brunel University, School of Information Systems, Computing and Mathematics, UB83P3, Uxbridge, Middlesex, mapsas@brunel.ac.uk, Diana Roman, Gautam Mitra

The increase in life expectancy is significant particularly in Asia, the expected growth of elderly aged 65 and above from year 2000 to 2050 is 314%. Pension reform is going to be an important challenge to be addressed. This paper will concentrate on the Provident Fund of Singapore, Malaysia, India and Sri Lanka. The similarities as well as the variations of current system will be discussed in term of size, performance, investments, dividends, contributions, withdrawals and etc. Proposed strategies in order to enhance the system as well as risk and difficulties faced will also be discussed.

WD-33

Wednesday 12:55-14:15
GSI - S 7
New Methods in Global Optimization

Stream: Global Optimization
Invited session
Chair: Leocadio G. Casado, Computer Architecture and Electronics, Universidad de Almeria, Ctra Sacramento s/n, La Canada de San Urban, 04120, Almeria, Spain, leo@ual.es

1 - From infeasibility in lp to global optimization
Paula Amaral, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, Departamento de Matemática, Campo da Caparica, 2829-516, Caparica, Lisbon, Portugal, paca@fct.unl.pt

Deciding about interesting regions in an infeasible LP is a difficult decision problem. Once a region is selected some action must be done to repair the constraints that are infeasible for all the points in that region. This issue can be addressed as a quadratic fractional problem. Branch and Bound approaches to find global optimal solutions are proposed given emphasis to the construction of lower bounding problems.

2 - On partitioning simplices and covering by spheres
Leocadio G. Casado, Computer Architecture and Electronics, Universidad de Almeria, Ctra Sacramento s/n, La Canada de San Urban, 04120, Almeria, Spain, leo@ual.es, Eligius M.T. Hendrix, I. Garcia

Simplices are used as partition sets in Branch and Bound algorithms for instance to determine mixture designs. One of our questions is how to partition them in an efficient way. The second question is how to prove that they cannot contain the optimum or a feasible set if spheres around the vertices are given that are proven not to contain solutions of the problem to be solved. We show a new way to apply overlapping regular simplices and proof several results of the covering problem.

3 - Global optimization of a generalized linear multiplicative program
Claudio Sodini, Statistics and Applied Mathematics, University of Pisa, Via Cosimo Ridolfi, 10, 56124, Pisa, Italy, csodini@cc.unipi.it, Riccardo Cambini

In this paper a solution algorithm for a class of generalized linear multiplicative programs having a polyhedral feasible region is proposed. The algorithm is based on the so called optimal level solutions method. Some optimality conditions are used to improve the performance of the proposed algorithm. Results of a computational test are provided.

4 - A practical approach for derivative-free simulation-based constrained optimization
Benoit Couet, Schlumberger-Doll Research, 02139, Cambridge, MA, United States, couet1@slb.com, Hugues Dijkstra, David Wilkinson

We propose an original, derivative-free, lexicographic scheme to efficiently solve optimization problems subject to both analytical and simulation-based constraints. After classifying all constraints depending on their computational costs, points not satisfying the linear constraints are feasibilized. A sequential lexicographic ordering is then applied in which the inexpensive nonlinear constraints take precedence over expensive ones, which in turn take precedence over objective values. The usefulness of the proposed method is demonstrated using oil-field production optimization examples.
According to statistics, between 7% to 25% of health expenditures occur during the early years of health care. Although there are control mechanisms, such as Electronic Claim Processing Systems, these mechanisms are not always reliable. At the beginning of 2000s, BI applications were widely used to detect fraud. However, these applications were not always effective in detecting fraud cases. New approaches, such as data mining, have been developed to address these issues.

It is important to note that paradoxical sleep apnea patients are different than other sleep apnea patients. As a consequence, we show how the well-established notions of directed tree-width (on digraphs) and hypertree-width (on hypergraphs) are related, and how both can be defined in terms of a graph searching game on undirected graphs.

**WD-34**

**Wednesday 12:55-14:15**

**GSI - S 8**

**Data Mining in Healthcare Informatics**

Stream: Machine Learning and Its Applications

*Invited session*

Chair: Nazife Baykal, Middle East Technical University, Informatics Institute, 06531, Ankara, Turkey, baykal@i.metu.edu.tr

**1 - Toward effective information retrieval in medical domain**

Mohammed AL Zamil, Information Systems, Middle East Technical University, METU, 06531, ANKARA, Ankara, Turkey, e152255@metu.edu.tr

We present a new model for domain-specific IR. It is emulating the gravitational law of gravity on bodies by extracting the degree of attractiveness among documents. The purpose is to make domain search engines, specifically medical engines, as effective as general ones. The relationships among documents are represented by a document network that reflects the semantic associations among documents. The importance of such network is to assess the quality of discovered documents because recent experiments in the field showed that closely related documents tend to be relevant to the same request.

**2 - Data mining and knowledge discovery at the sleep laboratory studies in psychophysiological and paradoxical sleep apnea patients**

Beyza Kaymakoglu, XXX, 06810, Ankara, Turkey, beyzakaymakoglu@birim.com.tr, Akin Akyuz, Sureyya Ozogar-Akyuz, Nazife Baykal, Fuat Ozgen

The quantities and amplitudes of delta waves for paradoxical sleep apnea patients are different than other sleep apnea patients. As a consequence of the changes in delta waves, paradoxical sleep apnea patients’ sleep perceptions are negatively affected which could be the result of previous psychiatric pathological problems. The distribution/scattering of delta waves in EEG, percentage, total delta quantity, amplitude of delta waves, comparison of paradoxical apnea with normal and psychophysiological apnea. We are obtaining subjective sleep evaluation of the patients using the post-sleep forms.

**3 - Fraud in healthpayment; a streamline from business intelligence to data mining**

Alp Timurhan Cevik, Tepe International, 06531, Ankara, Turkey, acevik@tepeinternational.com.tr, Gulsultan Dogan

According to statistics, between 7% to 25% of health expenditures are coming from fraud. Although there are control mechanisms, the health expenditures occurs. e-g, Electronic Claim Processing Systems, still there have to be retrospective controls. At the beginning of 2000s, BI applications made easy to analyse the data and detect fraud cases. Although BI applications are very helpful for the analyser to detect to fraud, still this models depend on the person who makes analysing. Data mining could help to create a magic box that contains algorithms to determine the fraud in the health expenditures.
Optimization problems depending on a probability measure correspond to many applications. It happens often that the "underlying" probability measure is completely unknown and, consequently, an empirical measure has to replace the unknown measure. A lot of efforts have been paid to introduce assumptions under which the corresponding estimates have "good" properties. However, these assertions have been proven under known "classical" assumptions and it is known that the problems corresponding to new situations have not fulfilled them. We plan to deal with just these cases.

2 - Insensitivity bounds for the moments of the sojourn times in m/g/1 systems under state-dependent processor sharing

Manfred Brandt, Optimization, Konrad-Zuse-Zentrum für Informationstechnik Berlin (ZIB), Takustr. 7, 14195, Berlin, Germany, brandt@zib.de, Andreas Brandt

We consider a system with Poisson arrivals and i.i.d. service times and where the requests are served according to the state-dependent (Cohen’s generalized) processor sharing discipline, where each request receives a service capacity which depends on the actual number of requests in the system. For this system we derive asymptotically tight upper bounds for the moments of the conditional sojourn time of a request with given required service time. The bounds generalize corresponding results given for the single-server processor sharing system by Cheung et al.

3 - Linear stability analysis for stochastic theta-methods applied to systems of sodes

Evelyn Buckwar, Department of Mathematics, Heriot-Watt University, Riccarton, EH14 4AS, Edinburgh, United Kingdom, e.buckwar@hw.ac.uk

In the first part of the talk I will consider a scalar equation driven by several Wiener processes and compare the stability behaviour of Theta-Maruyama and Theta-Milstein methods. In the second part I will study certain systems of ODES that are subject to stochastic perturbations with a structure that is known to a.s. stabilise or destabilise equilibrium solutions. Then I will present a mean-square and a.s. stability analysis of the Theta-discretisations of these test equations. The talk is based on joint work with Conall Kelly and Thorsten Sickenberger.
The main ideas, results and methods behind the worst-case approach to portfolio optimization in continuous time will be presented. This will cover the indifference approach, the HJB-system approach and the very recent martingale approach. We illustrate the difference to conventional portfolio optimization with explicitly solved examples.

2 - Optimal leverage factor for the constant proportion debt obligations: a martingale approach

Aysegil Iscanoglu, Financial Mathematics, Institute of Applied Mathematics, INSTITUTE OF APPLIED MATHEMATICS - MIDDLE EAST TECHNICAL UNIVERSITY, 06531, A NKARA, iscanoglu@yahoo.com, Ralf Korn, Ömür Ugur

The Constant Proportion Debt Obligation (CPDO) is a newly developed product of the structured credit market. The important concept of the CPDO is the leverage factor which provides the additional returns to the holders. In the study, we provide a solution to the optimal leverage factor by Martingale Method. In the analysis, we try to optimize the Euclidean distance between the hedging portfolio and CPDO at maturity.

3 - Numerical methods for nonlinear black-scholes equations

Pascal Heider, Mathematisches Institut, Universität zu Köln, Weyertal 86-90, 50931, Köln, pheader@mi.uni-koeln.de

In recent years non-linear Black-Scholes models have been used to build transaction costs, market liquidity or volatility uncertainty into the classical Black-Scholes concept. The non-linear equations can be discretized by BDF methods. These algorithms are fully implicit but require additional Newton iterations. We show that the numerical solution converges to the viscosity solution. The mathematical framework is handy and a wide range of models can easily be handled. The flexibility of the method is shown by application to four representative non-linear models.
Private Sector Applications of Simulation

Stream: Simulation Applications in Private and Public Organizations

Invited session

Chair: Murat Cauer Testik, Industrial Engineering, Hacettepe University, Hacettepe University, Turkey, mtestik@hacettepe.edu.tr

Chair: Banu Yuksel Ozkaya, Department of Industrial Engineering, Hacettepe University, Hacettepe University, Department of Industrial Engineering, Hacettepe, Ankara, Turkey, byuksel@hacettepe.edu.tr

1 - Simulation analysis of a cold-standby system

Ebru Yuksel, Industrial Engineering, Hacettepe University, Beytepe, 06800, Ankara, Ankara, Turkey, eyuksel@hacettepe.edu.tr, Guldal Guleryuz

In this study, a stochastic system with N identical, independent units and S cold-standby units with R repairmen is considered. The units are subject to random failures and it is assumed that both failure rates and repair rates are exponential. The system has large number of units, consequently it has fast switches. The system is simulated for different sets of parameters. Observed trajectory of the simulated system is represented with an analytical function. Behavior of the trajectory is investigated in transient phase with respect to different values of the system parameters.

2 - Evaluation of var and cvar as decision criteria in supply contracts

Berrak Dag, ER1-030 Enterprise Research Centre University of Limerick, Limerick, Ireland, berrakdag@yahoo.com, Paul Liston, Cathal Heavey

In this study, we aim to help companies with the contract selection process by proposing some decision criteria. These decision criteria are based on risk measurements in financial analysis; Value at Risk (VaR) and Conditional Value at Risk (CVaR). We use case study data and a contract costing simulation model, which examines the cost drivers in a typical outsourced manufacturing supply chain, to investigate the decision criteria and the decision process and then draw conclusions as to which criterion is better in different situations.

3 - A hybrid forecasting approach for a rental company's purchasing decisions

Ruohui Yang, School of Informatics, University of Bradford, 61 Quinton Road, CV3 5FE, Coventry, reena.yang@gmail.com, Peter Cowling, Keshav Dahal

This paper proposes a hybrid approach for a real-world accumulative equipment usage forecasting problem as a key component of a purchasing decision support system (PDSS) to assist a rental company’s decision on whether to sub-hire or purchase equipment to meet shortfalls. The hybrid approach adds the company’s revenue data as a parameter into the forecasting model to model demand growth. With simulations designed in MatLab, results show that the proposed hybrid approach significantly improves the accuracy of forecasts, compared with the best single forecasting method merely on previous data.

Novel opportunities of DC programming and DCA for Industry and Finance

Stream: Nonconvex Programming: Local and Global Approaches - Theory, Algorithms and Applications

Invited session

Chair: Anh Son Ta, LMI, INSA de Rouen, +33, Rouen, France, taanh_son@yahoo.com

1 - Dc programming approach for berth scheduling

Babacar Mbaye Ndaiye, BP 45087 Dakar-Fann, 99000, Dakar, Senegal, ndaiyemb@insa-rouen.fr, Tao Pham Dinh, Hoai An Le Thi

We present the DC (Difference of Convex functions) Programming and the DC Algorithm (DCA) for solving the continuous berth-scheduling problem in port container terminals. The objective is to determine the berthing times and positions of containerships during the loading and unloading operations of containers. Every vessel requires a specific amount of space in a wharf for a predetermined length of time to load and unload containers. We formulated a mixed integer programming model and the performance of the algorithm is tested on a set of data. The computational results are presented.

2 - Dc programming approach for portfolio decision with higher order moments

Yi-Shuai Niu, Laboratoire de Mathématiques de l’INSIA (LMI), National Institute for the Applied Science (INSA-ROUEN), INSA de Rouen LMI - Place Emile Blondel - BP 08 76131 Mont-Saint-Aignan, France, 76131, Rouen, France, niuys@insa-rouen.fr, Tao Pham Dinh

We propose a new efficient method based on DC Programming and DC Algorithm for solving the portfolio selection problem with higher moments (Mean-Variance-Skewness-Kurtosis based). The problem is characterized as a nonconvex, large-scale, fourth order polynomial programming problem, which is difficult to be solved, especially when a large number of variables are encountered. The proposed approach is significantly efficient for relatively large-scale problems. Numerical results and comparisons with other methods are reported, which show the feasibility, efficiency, and globality of our method.

3 - Dca for solving continuous min max problem for single period portfolio selection

Hoai An Le Thi, Computer Science, University Paul Verlaine - Metz, Ile du Saulcy., 57 045 , Metz, lethi@univ-metz.fr, Duc Quynh Tran

We consider the continuous min-max model to worst-case portfolio selection with multiple scenarios of risks where the return forecast of assets belongs to an interval. The problem can be formulated as minimizing a linear function under linear/quadratic constraints with additional complementarity constraints. DC (Difference of Convex functions) programming and DCA (DC Algorithm), an innovative approach in nonconvex programming framework has been developed for solving this problem. Numerical experiments on several test problems are reported that show the efficiency of the proposed algorithm.

4 - Optimal spectrum balancing in multi-user dsl network by d.c programming and dca

Anh Son Ta, LMI, INSA de Rouen, +33, Rouen, France, taanh_son@yahoo.com, Hoai An Le Thi, Tao Pham Dinh, Tho Le Ngoc
Dynamic spectrum management (DSM) is an effective technique for mitigating detrimental effect of crosstalk in Digital Subscriber Lines (DSL). Among various DSM techniques, centralized Optimal Spectrum Balancing (OSB) achieves the maximum data rates by computing the optimal PSDs for all modems in DSL systems. In this paper we investigate a new and efficient algorithm based on DC (Difference of Convex functions) programming and DCA (DC Algorithms) for solving nonconvex optimization problems in OSB. Preliminary numerical experiments on real-world data show the efficiency of the proposed algorithm.

Financing a privately owned home is a complex issue for most of us. First we save some equity, then we use this and additional dept to pay for the home, and then we have to repay the dept. The whole process is subject to interest rate and inflation risk, which depends crucially on the amount of equity used and the terms of the loan, particularly the time span for which interest rates are fixed. We set up an appropriate model to evaluate alternative strategies. As an innovative and appropriate risk measure we use the overall time needed to complete the financing process.

### WD-43

**Wednesday 12:55-14:15**  
**GSI - S 10**  
**Long Term Financing and Investment 1**  
Stream: Long Term Financial Decisions  
*Invited session*  
Chair: Ursula Walther, Frankfurt School of Finance and Management, Sonnemannstrasse 9-11, 60314, Frankfurt/M, Germany, u.walther@frankfurt-school.de

**1** - The profitability of investment certificates in different tax systems? do structured products benefit from taxation?  
Peter Scholz, Frankfurt School of Finance and Management, 60314, Frankfurt am Main, Germany, p.scholz@frankfurt-school.de, Ursula Walther

Despite the strong growth of the open interest of investment certificates their profitability is questionable. Previous research has concentrated on costs, portfolio-theoretical issues and counterparty risk. So far, the impact of taxes has not been systematically analysed. In order to fill this gap we run historical simulations based on market data under three different taxation schemes: a world without taxes, the previous German tax system and the new flat-tax system. To compare the resulting return distributions and measure relative advantages we adapt concepts of stochastic dominance.

**2** - Credit dynamics in a first-passage time model with jumps  
Natalie Packham, Quantitative Finance, Frankfurt School of Finance and Management, Sonnemannstrasse 9-11, 60314, Frankfurt/M, Germany, n.packham@frankfurt-school.de

The payoff of many credit derivatives depends on the level of credit spreads. In particular, the payoff of credit derivatives with a leveraged component is sensitive to jumps in the underlying credit spreads. In the framework of first-passage time models we extend a model by Overbeck and Schmidt (2005) to address these issues. In the extended model a credit quality process is driven by an Ito integral with respect to a Brownian motion with stochastic volatility. We examine the dynamics of the model and provide examples.

**3** - Financing a privately owned home - a time oriented risk analysis of combined savings and financing activities  
Ursula Walther, Frankfurt School of Finance and Management, Sonnemannstrasse 9-11, 60314, Frankfurt/M, Germany, u.walther@frankfurt-school.de, Thomas Burkhardt

### WD-44

**Wednesday 12:55-14:15**  
**GSI - S 16**  
**Meeting of the EURO WG in OR in Agriculture and Forest Management**  
Stream: OR in Agriculture and Forest Management  
*Invited session*  
Chair: Lluis M Pla, Mathematics, University of Lleida, JaumeII,73, 25001, Lleida, Spain, lpla@matematica.udl.es

**1** - Euro wg in OR in agriculture and forest management  
Lluis M Pla, Mathematics, University of Lleida, JaumeII,73, 25001, Lleida, Spain, lpla@matematica.udl.es

Meeting of the EURO WG in OR in Agriculture and Forest Management

### WD-45

**Wednesday 12:55-14:15**  
**GSI - S 33**  
**Various Topics of OR in Education**  
Stream: OR Applications in Education  
*Invited session*  
Chair: Annette Hohenberger, Middle East Technical University (METU), Informatics Institute, Cognitive Science Program, Inonu Bulvari, 06531, Ankara, Turkey, hohenberger@ii.metu.edu.tr  
Chair: Heiner Müller-Merbach, Wirtschaftswissenschaften, Universität Kaiserslautern, Postfach 3049, 67653, Kaiserslautern, Germany, hmm@bior.de  
Chair: Seren Basaran, Secondary Science and Mathematics Education, Middle East Technical University, Informatics Institute - METU, 06531 Ankara Turkey, Turkey, sbasaran@ii.metu.edu.tr

**1** - Management sciences and quantitative methods in management education in the uk  
Alberto Paucar-Caceres, Business School, Manchester Metropolitan University, Aytoun Street, Aytoun Building, M1 3GH, MANCHESTER, United Kingdom, a.paucar@mmu.ac.uk, Rosane PAgano
We review the development of management science (MS) and management science methodologies (MSM) in management education by examining a sample of syllabuses of UG business courses and MBA courses in the UK. The academic phase of early MS/OR is outlined and a framework of four groups of MSM in use is proposed. Results indicate that most Business UG and MBA courses include a unit in Quantitative methods in the first year. Universities are still at large teaching the ‘hard’ methods and the type of problem solving methods developed in the 50s and 60s and ‘soft’ MSMs are rarely taught.

2 - Using a problem-based approach in the design of an OR course: targeting management student-workers

Joao Miranda, Area de Engenharia, Escola Superior de Tecnologia e Gest, Lugar da Abadessa, Apt 148, 7301-901, Portalegre, Portugal, jlimiranda@estgp.pt

In a Management graduation course, a Problem-Based approach and computer-aided support are used to promote the learning of OR basics by student-workers. The methodology relies in specific problems built to promote reasoning, to conjugate business or enterprise environment with OR quantitative methods, namely: decision support, game theory, Linear Programming and some special cases. The perspectives of optimality and uncertainty are aimed through a set of case problems that are designed to meet the needs of student-workers, in an introductory OR course of Bologna first cycle.

3 - Children born of war and the compram methodology

Ingvill Constanze Mochmann, EUROLAB, GESIS-Leibniz Institute for the Social Sciences, Bachener Str. 40, 50931, Cologne, NRW, ingvill.mochmann@gesis.org, Dorien DeTombe

Children are born during and after wars, where the father is a member of an enemy, allied or peacekeeping force and the mother a local citizen. The human rights of these children are often at risk and little attention is paid to this group and their complex situation by authorities and humanitarian organisations. Using the COMPRAM methodology implementations which may be of particular relevance to secure the rights of this vulnerable group will be presented and discussed.

4 - The OR process: five item analysis

Heiner Müller-Merbach, Wirtschaftswissenschaften, Universität Kaiserslautern, Postfach 3049, 67653, Kaiserslautern, Germany, hmm@biol.de

The "Five Item Analysis" (FIA) is a general approach to problems in social systems of any kind. It includes: (i) Analysis of the current state of the system under study; (ii) Definition of future goals; (iii) Design of the future state of the system; (iv) Transformation of the system from the current into the future state; (v) Calculating the means (people, machinery, money etc.) for the transformation. Any item may require mathematics.
This talk will present an overview into research conducted by the Automated Scheduling, Optimisation and Planning Research group on cutting and packing methodologies. It will focus on advances that have been made by our team over recent years. First of all, it will address the non-guillotine variant of the rectangular packing problem. A heuristic method based on the methodology of best-fit will be presented. After this, the packing of irregular shapes will be discussed and new algorithms will be presented that maintain full accuracy with shapes that may contain lines, arcs and holes. In both the rectangular and irregular variants of the stock cutting problem, the presented algorithms produce significantly better results than the previous state of the art on a wide range of benchmarks from over 20 years of cutting and packing research. As a direct result of this work we have founded a spin-out company, Aptia Solutions Ltd, to further develop and commercialise these algorithms and the talk will conclude by discussing some of the commercial issues facing this research area.

2 - Sports scheduling and advances in integer and constraint programming

*Michael Trick*, Tepper School of Business, Carnegie Mellon University, Tepper Room 338, 15213, Pittsburgh, PA, United States, trick@cmu.edu

Advances in sports scheduling methods are changing how professional and amateur schedules are created. Leagues around the world are using optimization and related approaches for their team and officials scheduling. I will give some experiences in scheduling real sports leagues and outline what I believe are the major trends in optimization that are making it easier to create high quality schedules. My experiences come from leagues that range from a local children’s football (soccer) league to scheduling the 2430 games that make up a single year’s schedule for the US Major League Baseball. Computational methods from ten years ago are insufficient to attack these problems, even on today’s computers, but recent advances in integrating integer and constraint programming, large neighborhood local search, and variable redefinition create powerful, flexible solution methods.

### Wednesday 16:15-17:00

#### WF-01

*Closed Session*

Stream: Plenaries

**Plenary session**

Chair: *Erwin Pesch*, FB 5, University of Siegen, Hoelderlinstr. 3, 57068, Siegen, Germany, erwin.pesch@uni-siegen.de

Chair: *Gerhard J. Woeginger*, Department of Mathematics and Computer Science, Eindhoven University of Technology, 5600 MB, Eindhoven, Netherlands, gwoegi@win.tue.nl

1. Welcome
2. Announcements of awards - Winner of EURO Excellence in Practice Award - Winner of EURO Doctoral Dissertation Award - Winner of the EURO Management Science Strategic Innovation Prize (MSSIP)
3. Announcements of special journal issues organized around EURO; in particular the special issue of EJOR
4. Presentation of the ROADEF challenge/EURO 2010, an OR challenge dedicated to industrial applications: A large scale energy management problem with diversified constraints, proposed by EDF (http://challenge.roadef.org)
6. Concluding remarks
### Agent-based modelling
**Invited**
Massimo Genoese  
University of Karlsruhe  
massimo.genoese@kit.edu  
**Track(s):** 32  
1 session

### Analytic hierarchy processes, analytic network processes
**Invited**
Josef Jablonsky  
University of Economics Prague  
jablonsky@vse.cz  
Y. Ilker Topcu  
Istanbul Technical University  
ilker.topcu@itu.edu.tr  
**Track(s):** 5 20 21 22 23  
12 sessions

### Application of fuzzy logic & real options to corporate management decision-making
**Invited**
Mikael Collan  
Åbo Akademi University  
mcollan@abo.fi  
**Track(s):** 34  
2 sessions

### Application in business intelligence and knowledge discovery
**Invited**
Richard Weber  
University of Chile  
rweber@di.uchile.cl  
**Track(s):** 34  
3 sessions

### Auctions
**Contributed**
Gerhard J. Woeginger  
Eindhoven University of Technology  
gwoegi@win.tue.nl  
**Track(s):** 27  
1 session
| Track(s): | 18 | 1 session |
|-----------|------------------------|
| Stream(s): | Invited |
| Title: | Convex optimization 2 |
| Speaker(s): | Angelia Nedich  
University of Illinois  
angelia@uiuc.edu |
| Speaker(s): | Asu Ozdaglar  
Mit  
asuman@mit.edu |
| Speaker(s): | Srma Zeynep Alparslan Gök  
Institute of Applied Mathematics, Middle East Technical University  
alzeynep@metu.edu.tr |
| Speaker(s): | Mariana Rodica Branzei  
"Alexandru Ioan Cuza” University  
branzeir@info.uaic.ro |
| Track(s): | 25 | 10 sessions |
| Stream(s): | Invited |
| Title: | Cooperative game theory |
| Speaker(s): | Jose Fernando Oliveira  
Universidade do Porto  
jfo@fe.up.pt |
| Speaker(s): | Dimitris Despotis  
University of Piraeus  
despotis@unipi.gr |
| Track(s): | 20 | 12 sessions |
| Stream(s): | Invited |
| Title: | Cutting and packing |
| Speaker(s): | Graham Kendall  
University of Nottingham  
gxk@cs.nott.ac.uk |
| Speaker(s): | Fatima Dargam  
SimTech Simulation Technology  
F.Dargam@SimTechnology.com |
| Track(s): | 37 | 8 sessions |
| Stream(s): | Contributed |
| Title: | Data mining |
| Speaker(s): | Roman Slowinski  
Poznan University of Technology  
roman.slowinski@cs.put.poznan.pl |
| Speaker(s): | Pascale Zarate  
Institut de Recherche en Informatique de Toulouse  
zarate@irit.fr |
| Track(s): | 37 | 8 sessions |
| Stream(s): | Contributed |
| Title: | Data mining and decision making |
| Speaker(s): | Hsin-Vonn Seow  
University of Nottingham-Malaysia Campus  
Hsin-Vonn.Seow@nottingham.edu.my |
| Speaker(s): | Xiaoling Sun  
Fudan University  
xls@fudan.edu.cn |
| Track(s): | 31 | 3 sessions |
| Stream(s): | Invited |
| Title: | Data mining and knowledge discovery |
| Speaker(s): | Yannis Theodoridis  
University of Piraeus  
ytheod@unipi.gr |
| Speaker(s): | Ozren Despic  
Aston University  
O.despic@aston.ac.uk |
| Track(s): | 32 | 3 sessions |
| Stream(s): | Invited |
| Title: | Data mining in quality improvement |
| Speaker(s): | Gulser Koksal  
Middle East Technical University  
koksal@ie.metu.edu.tr |
| Speaker(s): | Dimitris Despotis  
University of Piraeus  
despotis@unipi.gr |
| Track(s): | 31 | 2 sessions |
| Stream(s): | Invited |
| Title: | DEA and performance measurement |
| Speaker(s): | Alf Kimms  
University of Duisburg-Essen  
alf.kimms@uni-due.de |
| Speaker(s): | Robert Klein  
Universität Augsburg  
robert.klein@wiwi.uni-augsburg.de |
| Track(s): | 23 | 4 sessions |
| Stream(s): | Invited |
| Title: | Decision analysis |
| Speaker(s): | Heiner Kuhn  
Catholic University of Eichstaett-Ingolstadt  
heinrich.kuhn@ku-eichstaett.de |
| Speaker(s): | Winfried Steiner  
Clausthal University of Technology, Institute of Management and Economics  
winfried.steiner@tu-clausthal.de |
| Track(s): | 28 | 4 sessions |
| Stream(s): | Invited |
| Title: | Decision support systems |
| Speaker(s): | Peter Letmathe  
University of Siegen  
peter.letmathe@uni-siegen.de |
| Speaker(s): | Christian Hofmann  
University of Mannheim  
Hofmann@bw1.uni-mannheim.de |
| Track(s): | 6 | 1 session |
| Stream(s): | Invited |
| Title: | Demand and incentives |
| Speaker(s): | Fatima Dargam  
SimTech Simulation Technology  
F.Dargam@SimTechnology.com |
| Speaker(s): | Pascale Zarate  
Institut de Recherche en Informatique de Toulouse  
zarate@irit.fr |
| Track(s): | 23 | 4 sessions |
| Stream(s): | Invited |
| Title: | Decision support systems |
| Speaker(s): | Alf Kimms  
University of Duisburg-Essen  
alf.kimms@uni-due.de |
| Speaker(s): | Robert Klein  
Universität Augsburg  
robert.klein@wiwi.uni-augsburg.de |
| Track(s): | 23 | 4 sessions |
| Stream(s): | Invited |
| Title: | Discrete and global optimization |
| Speaker(s): | Xiaoling Sun  
Fudan University  
xls@fudan.edu.cn |
| Speaker(s): | Heiner Kuhn  
Catholic University of Eichstaett-Ingolstadt  
heinrich.kuhn@ku-eichstaett.de |
<p>| Track(s): | 30 | 1 session |</p>
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<th>STREAMS</th>
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<tbody>
<tr>
<td><strong>Discrete optimal control</strong></td>
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<tr>
<td>Invited</td>
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<td>Dmitrii Lozovanu</td>
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<td>Academy of Sciences of Moldova</td>
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<td><strong>Track(s):</strong> 45</td>
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<td><strong>Discrete optimization</strong></td>
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<td>Tamas Kis</td>
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<td>Computer and Automation Research Institute</td>
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<td><strong>Track(s):</strong> 26 27</td>
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<td><strong>Dynamic programming</strong></td>
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<td>Lidija Zadnik Stirn</td>
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<td>University of Ljubljana</td>
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<td>Moshe Sniedovich</td>
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<td><strong>Track(s):</strong> 30</td>
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<td><strong>Dynamical systems and game theory</strong></td>
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<td><strong>Economic lot scheduling problem</strong></td>
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<td>Anders Segerstedt</td>
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<td>Luleå University of Technology</td>
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<td>Denis Bouyssou</td>
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<td><strong>Track(s):</strong> 1</td>
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<td><strong>Energy and emission markets</strong></td>
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<td>Hans-Jakob Lithi</td>
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<td>Stefan Pickl</td>
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<td>Universität der Bundeswehr München</td>
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<td>Carlos Henggeler Antunes</td>
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<td>University of Coimbra and INESC Coimbra</td>
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<td><strong>Engineering optimization</strong></td>
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<td>Jose Herskovits</td>
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<td>Federal University of Rio de Janeiro</td>
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<tr>
<td><strong>Evolutionary multi objective optimization</strong></td>
</tr>
<tr>
<td>Invited</td>
</tr>
<tr>
<td>Juergen Branke</td>
</tr>
<tr>
<td>University of Warwick</td>
</tr>
<tr>
<td><a href="mailto:juergen.branke@wbs.ac.uk">juergen.branke@wbs.ac.uk</a></td>
</tr>
<tr>
<td><strong>Track(s):</strong> 10 11</td>
</tr>
<tr>
<td>5 sessions</td>
</tr>
<tr>
<td><strong>Excellence in practice award</strong></td>
</tr>
<tr>
<td>Invited</td>
</tr>
<tr>
<td>Geir Hasle</td>
</tr>
<tr>
<td>Sintef Ict</td>
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<tr>
<td><a href="mailto:Geir.Hasle@sintef.no">Geir.Hasle@sintef.no</a></td>
</tr>
<tr>
<td><strong>Track(s):</strong> 1</td>
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<tr>
<td>2 sessions</td>
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<tr>
<td><strong>Experimental economics and game theory</strong></td>
</tr>
<tr>
<td>Invited</td>
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<tr>
<td>Ulrike Leopold-Wildburger</td>
</tr>
<tr>
<td>Karl-Franzens-University</td>
</tr>
<tr>
<td><a href="mailto:ulrike.leopold@uni-graz.at">ulrike.leopold@uni-graz.at</a></td>
</tr>
<tr>
<td>Stefan Pickl</td>
</tr>
<tr>
<td>Universität der Bundeswehr München</td>
</tr>
<tr>
<td><a href="mailto:stefan.pickl@unibw.de">stefan.pickl@unibw.de</a></td>
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<tr>
<td><strong>Track(s):</strong> 14</td>
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<tr>
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<tr>
<td><strong>Facilitated modelling interventions</strong></td>
</tr>
<tr>
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<tr>
<td>L. Alberto Franco</td>
</tr>
<tr>
<td>University of Warwick</td>
</tr>
<tr>
<td><a href="mailto:alberto.franco@warwick.ac.uk">alberto.franco@warwick.ac.uk</a></td>
</tr>
<tr>
<td>Gilberto Montibeller</td>
</tr>
<tr>
<td>London School of Economics</td>
</tr>
<tr>
<td><a href="mailto:g.montibeller@lse.ac.uk">g.montibeller@lse.ac.uk</a></td>
</tr>
<tr>
<td><strong>Track(s):</strong> 35</td>
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<tr>
<td><strong>Facility logistics</strong></td>
</tr>
<tr>
<td>Invited</td>
</tr>
<tr>
<td>John Bartholdi</td>
</tr>
<tr>
<td>Georgia Institute of Technology</td>
</tr>
<tr>
<td><a href="mailto:john.bartholdi@isye.gatech.edu">john.bartholdi@isye.gatech.edu</a></td>
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<td><strong>Track(s):</strong> 27</td>
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<tr>
<td><strong>Financial modelling</strong></td>
</tr>
<tr>
<td>Invited</td>
</tr>
<tr>
<td>Georg Pflug</td>
</tr>
<tr>
<td>University of Vienna</td>
</tr>
<tr>
<td><a href="mailto:georg.pflug@univie.ac.at">georg.pflug@univie.ac.at</a></td>
</tr>
<tr>
<td>Rita D’Ecclesia</td>
</tr>
<tr>
<td>Università di Roma</td>
</tr>
<tr>
<td><a href="mailto:rita.decclesia@uniroma1.it">rita.decclesia@uniroma1.it</a></td>
</tr>
<tr>
<td>Ronald Hochreiter</td>
</tr>
<tr>
<td>University of Vienna</td>
</tr>
<tr>
<td><a href="mailto:ronald.hochreiter@univie.ac.at">ronald.hochreiter@univie.ac.at</a></td>
</tr>
<tr>
<td><strong>Track(s):</strong> 23 29</td>
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<tr>
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</tr>
</tbody>
</table>
Financial modelling  
Contributed  
Peter Letmathe  
University of Siegen  
peter.letmathe@uni-siegen.de  
Track(s): 32  
7 sessions  

Financial optimization  
Invited  
Gautam Mitra  
Brunel University  
gautam.mitra@brunel.ac.uk  
J. E. Beasley  
Brunel University  
john.beasley@brunel.ac.uk  
Track(s): 28  
6 sessions  

Fuzzy systems, neural networks & artificial intelligence  
Invited  
Heinrich Rommelfanger  
Goethe University  
Rommelfanger@wiwi.uni-frankfurt.de  
Hans Georg Zimmermann  
Siemens AG  
Hans_Georg.Zimmermann@siemens.com  
Track(s): 34  
3 sessions  

Game theory  
Contributed  
Gerhard J. Woeginger  
Eindhoven University of Technology  
gwoegi@win.tue.nl  
Track(s): 39  
4 sessions  

Global optimization  
Invited  
Eligius M.T. Hendrix  
Universidad de Málaga  
eligius.hendrix@wur.nl  
Janos D. Pinter  
PCS Inc. & Dalhousie University  
jdpinter@hfx.eastlink.ca  
Track(s): 33  
6 sessions  

Gor-awards  
Invited  
Stefan Nickel  
Universitaet Karlsruhe  
Stefan.Nickel@kit.edu  
Track(s): 6  
2 sessions  

Graph searching  
Invited  
Danny Dyer  
Memorial University of Newfoundland  
dyer@math.mun.ca  
Oznur Diner  
Memorial University of Newfoundland  
oyasar@mun.ca  
Boting Yang  
University of Regina  
boting@cs.uregina.ca  
Track(s): 35  
3 sessions  

Graphs and networks  
Invited  
Dominique de Werra  
EPFL  
dewerra@gmail.com  
Track(s): 17  
2 sessions  

Health care  
Contributed  
Florian Jaehn  
Management Information Science  
florian.jaehn@uni-siegen.de  
Track(s): 42  
3 sessions  

Health care management  
Invited  
Marion Rauner  
University of Vienna  
marion.rauner@univie.ac.at  
Stefan Nickel  
Universitaet Karlsruhe  
Stefan.Nickel@kit.edu  
Teresa Melo  
University of Applied Sciences  
teresa.melo@htw-saarland.de  
Jan Vissers  
Erasmus University Medical Centre  
j.m.h.vissers@erasmusmc.nl  
Track(s): 21  
4 sessions  

Inventory management  
Invited  
Stefan Minner  
University of Vienna  
stefan.minner@univie.ac.at  
Track(s): 14  
9 sessions  

Keynote talks  
Invited  
Gerhard J. Woeginger  
Eindhoven University of Technology  
gwoegi@win.tue.nl  
Erwin Pesch  
University of Siegen  
erwin.pesch@uni-siegen.de  
Track(s): 1 2 3  
9 sessions  

Knowledge discovery and data mining  
Invited  
Luís Cavique  
Universidade Aberta  
lcavique@univ-ab.pt  
Uwe Aickelin  
University of Bradford  
uwe.aickelin@nottingham.ac.uk  
Track(s): 27  
2 sessions
Knowledge discovery for decision support  
Contributed  
Roman Slowinski  
Poznan University of Technology  
roman.slowinski@cs.put.poznan.pl  
Track(s):  30  
2 sessions

Lean accounting  
Invited  
Frances Kennedy  
Clemson University  
fkenned@clemson.edu  
Track(s):  38  
2 sessions

Linear optimization  
Contributed  
Juan José Salazar González  
Universidad de La Laguna (Tenerife)  
jjsalaza@ull.es  
Track(s):  33  
6 sessions

Location analysis  
Invited  
Frank Plastria  
Vrije Universiteit Brussel  
Frank.Plastria@vub.ac.be  
Track(s):  12  13  14  
13 sessions

Long term financial decisions  
Invited  
Thomas Burkhardt  
Universität Koblenz-Landau  
tburkha@uni-koblenz.de  
Track(s):  41  43  
7 sessions

Machine learning and its applications  
Invited  
Kristiaan Pelckmans  
Katholieke Universiteit Leuven  
Kristiaan.Pelckmans@esat.kuleuven.be  
Jacob Kogan  
Umbc  
kogan@math.umbc.edu  
Sureyya Ozogur-Akyuz  
Sabanci University  
sozogur@sabanciuniv.edu  
Track(s):  34  
3 sessions

Mathematical models in macroeconomics  
Invited  
Claus Neidhardt  
FH Koblenz - RheinAhrCampus Remagen  
neidhardt@rheinahrcampus.de  
Jürgen Kremer  
FH Koblenz RheinAhrCampus Remagen  
kremer@rheinahrcampus.de  
Track(s):  42  
2 sessions

Mathematical programming  
Invited  
Karel Zimmermann  
Charles University  
zimmermann@seznam.cz  
Alexander Martin  
TU Darmstadt  
martin@mathematik.tu-darmstadt.de  
Tamas Terlaky  
McMaster University  
terlaky@mcmaster.ca  
Imre Polik  
Lehigh University  
imre.polik@gmail.com  
Gerhard-Wilhelm Weber  
Middle East Technical University  
gweber@metu.edu.tr  
Track(s):  18  
12 sessions

Metaheuristics  
Invited  
Kenneth Sörensens  
Universiteit Antwerpen  
kenneth.sorensen@ua.ac.be  
Marc Sevaux  
Université de Bretagne Sud - UEB  
marc.sevaux@univ-ubs.fr  
Andreas Reinholz  
University Dortmund  
andreas.reinholz@gmx.de  
Track(s):  19  
8 sessions

Metaheuristics and information systems  
Contributed  
Tamas Kis  
Computer and Automation Research Institute  
tamas.kis@sztaki.hu  
Track(s):  19  
2 sessions

Methodology of societal complexity  
Invited  
Dorien DeTombe  
Chair Euro Working Group  
detombe@nosmo.nl  
Track(s):  45  
3 sessions

Migration, education and sustainable development  
Invited  
Hanife Akar  
Middle East Technical University  
hanif@metu.edu.tr  
Track(s):  44  
3 sessions

Mining  
Invited  
Alexandra Newman  
Colorado School of Mines  
newman@mines.edu  
Track(s):  33  
1 session
Modelling large mips
Contribution
Oliver Bastert
Fico
oliverbastert@fico.com
Track(s): 28
1 session

Multi-objective optimization and decision theory 1
Invited
José Rui Figueira
Technical University of Lisbon
figueira@ist.utl.pt
Kathrin Klamroth
University of Wuppertal
klamroth@math.uni-wuppertal.de
Track(s): 16
6 sessions

Multi-objective optimization and decision theory 2
Invited
Jutta Geldermann
Georg-August-Universitaet
Goettingen
geldermann@wiwi.uni-goettingen.de
Christiane Tammer
Martin-Luther-University
Halle-Wittenberg
christiane.tammer@mathematik.uni-halle.de
Track(s): 15 16
2 sessions

Multiple criteria decision analysis
Invited
José Rui Figueira
Technical University of Lisbon
figueira@ist.utl.pt
Salvatore Greco
University of Catania
salgreco@unict.it
Track(s): 7 10 11 12
18 sessions

Network optimization
Invited
Bernard Fortz
Université Libre de Bruxelles
bfourtz@euro-online.org
Luis Gouveia
University of Lisbon
legouveia@fc.ul.pt
Track(s): 3 4
6 sessions
Nonconvex programming: local and global approaches - theory, algorithms and applications
Invited
Tao Pham Dinh
INSA Rouen
pham@insa-rouen.fr
Hoai An Le Thi
University Paul Verlaine - Metz
lethi@univ-metz.fr
Track(s): 42
3 sessions
Noncooperative games
Invited
Ignacio García-Jurado
Coruna University
igjurado@udc.es
Track(s): 31
2 sessions
Nonlinear programming
Invited
E. Alper Yildirim
Bilkent University
yildirim@bilkent.edu.tr
Tatiana Tehemisova
Aveiro University
tatiana@mat.ua.pt
Olga Kostyukova
Belarusian National Academy of Sciences
kostyukova@im.bas-net.by
Track(s): 24
7 sessions

Nonsmooth optimization and its applications
Invited
Adil Bagirov
University of Ballarat
a.bagirov@ballarat.edu.au
Refail Kasimbeyli
Izmir University of Economics
refail.kasimbeyli@ieu.edu.tr
Antonio Fuduli
Universita’ della Calabria
antonio.fuduli@unical.it
Track(s): 30
3 sessions
Numerical methods in finance
Invited
Ömür Ugur
Middle East Technical University
ougur@metu.edu.tr
Track(s): 38
2 sessions
Operational research and quantitative models in banking
Invited
Constantin Zopounidis
Technical University of Crete
kostas@dpem.tuc.gr
Track(s): 39
4 sessions
Optimal control
Invited
Erik Kropat
Friedrich-Alexander University
Erlangen-Nuremberg
kropat@am2.am.uni-erlangen.de
Gustav Feichtinger
Vienna University of Technology
or@eos.tuwien.ac.at
Gerhard-Wilhelm Weber
Middle East Technical University
gweber@metu.edu.tr
Track(s): 42
3 sessions
Optimal control in finance and insurance
Invited
Ulrich Rieder
University of Ulm
ulrich.rieder@uni-ulm.de
Nicole Baeuerle
University of Karlsruhe
baeuerle@stoch.uni-karlsruhe.de
Track(s): 36
4 sessions

Optimization and data mining
Invited
Emilio Carrizosa
Universidad de Sevilla
e carrizosa@us.es
Theodore Trafalis
University of Oklahoma
ttrafalis@ou.edu
Renato De Leone
Università di Camerino
renato.deleone@unicam.it
Track(s): 31
4 sessions

Optimization in public transport
Invited
Leo Kroon
Erasmus University Rotterdam
LKroon@rsm.nl
Anita Schoebel
Georg-August Universität Göttingen
schoebel@math.uni-goettingen.de
Track(s): 7 8
18 sessions

OR and environmental management
Invited
Peter Letmathe
University of Siegen
peter.letmathe@uni-siegen.de
Axel Tuma
University of Augsburg
axel.tuma@wiwi.uni-augsburg.de
Track(s): 22
7 sessions

OR and ethics
Invited
Fred Wenstop
Norwegian School of Management BI
fred.wenstop@bi.no
Track(s): 45
2 sessions

OR and real implementations
Invited
Ben Lev
University of Michigan - Dearborn
blev@umich.edu
Belarmino Adenso-Diaz
Universidad de Oviedo
adenso@epsig.uniovi.es
Track(s): 6
9 sessions

OR applications in education
Invited
Seren Basaran
Middle East Technical University
sbasaran@i.metu.edu.tr
Track(s): 45
3 sessions

OR applications in industry
Invited
Bjarni Kristjansson
Maximal Software, Ltd.
bjarni@maximalsoftware.com
Eleni Pratsini
IBM Zurich Research Lab
pra@zurich.ibm.com
Jo van Nunen
RSM Erasmus University
j nunen@rsm.nl
Track(s): 1 22
4 sessions

OR for development and developing countries
Invited
Leroy White
University of Bristol
Leroy.White@bristol.ac.uk
Gerhard-Wilhelm Weber
Middle East Technical University
gweber@metu.edu.tr
Marthi Harmse
Sasol Technology
marthi.harmse@sasol.com
Honora Smith
University of Southampton
honora smith@soton.ac.uk
Track(s): 40
6 sessions

OR in agriculture and forest management
Invited
LluisM Pla
University of Lleida
lpla@matematica.udl.es
Manfred Gronalt
University of Natural Resources and Applied Life Sciences, Vienna
manfred.gronalt@boku.ac.at
Track(s): 41 44
6 sessions

OR in sports
Invited
Michael Trick
Carnegie Mellon University
trick@cmu.edu
Dirk Briskorn
University of Kiel
briskorn@bwl.uni-kiel.de
Track(s): 15 16
2 sessions

OR applications in education
Invited
Seren Basaran
Middle East Technical University
sbasaran@i.metu.edu.tr
Track(s): 45
3 sessions

OR applications in industry
Invited
Bjarni Kristjansson
Maximal Software, Ltd.
bjarni@maximalsoftware.com
Eleni Pratsini
IBM Zurich Research Lab
pra@zurich.ibm.com
Jo van Nunen
RSM Erasmus University
j nunen@rsm.nl
Track(s): 1 22
4 sessions

OR for development and developing countries
Invited
Leroy White
University of Bristol
Leroy.White@bristol.ac.uk
Gerhard-Wilhelm Weber
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gweber@metu.edu.tr
Marthi Harmse
Sasol Technology
marthi.harmse@sasol.com
Honora Smith
University of Southampton
honora smith@soton.ac.uk
Track(s): 40
6 sessions

OR in agriculture and forest management
Invited
LluisM Pla
University of Lleida
lpla@matematica.udl.es
Manfred Gronalt
University of Natural Resources and Applied Life Sciences, Vienna
manfred.gronalt@boku.ac.at
Track(s): 41 44
6 sessions

OR in sports
Invited
Michael Trick
Carnegie Mellon University
trick@cmu.edu
Dirk Briskorn
University of Kiel
briskorn@bwl.uni-kiel.de
Track(s): 15 16
2 sessions
<table>
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<th>STREAMS</th>
<th>EURO 23 - Bonn 2009</th>
</tr>
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| **Parametric optimization**  
*Invited*  
Georg Still  
University of Twente  
g.still@math.utwente.nl  
Juergen Guddat  
HU Berlin  
jguddat@mathematik.hu-berlin.de  
Track(s): 44  
2 sessions  
**Plenaries**  
*Invited*  
Gerhard J. Woeginger  
Eindhoven University of Technology  
gwoegi@win.tue.nl  
Track(s): 1  
4 sessions  
**Preference learning from data**  
*Invited*  
Roman Slowinski  
Poznan University of Technology  
roman.slowinski@cs.put.poznan.pl  
Track(s): 16  
2 sessions  
**Production and operations management**  
*Contributed*  
Erwin Pesch  
University of Siegen  
erwin.pesch@uni-siegen.de  
Track(s): 41  
2 sessions  
**Project management and scheduling**  
*Invited*  
Rainer Kolisch  
Technische Universität München  
rainer.kolisch@wi.tum.de  
Christoph Schwindt  
Clausthal University of Technology  
christoph.schwindt@tu-clausthal.de  
Track(s): 15  
3 sessions  
**Revenue management**  
*Invited*  
Houyuan Jiang  
University of Cambridge  
h.jiang@jbs.cam.ac.uk  
Ayse Kocabiyikoglu  
Bilkent University  
aysekoca@bilkent.edu.tr  
Track(s): 37  
4 sessions  
**Scheduling**  
*Contributed*  
Tamas Kis  
Computer and Automation Research Institute  
tamas.kis@sztaki.hu  
Track(s): 39 41  
6 sessions  
**Scheduling under resource constraints**  
*Invited*  
Jan Weglarz  
Poznan University of Technology  
jan.weglarz@cs.put.poznan.pl  
Joanna Jozebowska  
Poznan University of Technology  
jjozebowska@cs.put.poznan.pl  
Track(s): 17  
5 sessions  
**Sd modelling in sustainable development**  
*Invited*  
Pierre Kunsch  
Vrije Universiteit Brussel  
p.kunsch@vub.ac.be  
Track(s): 40  
2 sessions  
**Semi-infinite optimization**  
*Invited*  
Jan-J Ruckmann  
University of Birmingham  
J.Ruckmann@bham.ac.uk  
Oliver Stein  
University of Karlsruhe  
stein@wior.uni-karlsruhe.de  
Miguel Gobena  
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mgobena@ua.es  
Maxim Todorov  
University de las Americas  
maxim.todorov@udlap.mx  
Marco A. López-Cerdá  
Alicante University  
marcoantonio@ua.es  
Track(s): 24  
6 sessions  
**Simulation**  
*Contributed*  
Horst W. Hamacher  
University of Kaiserslautern  
hamacher@mathematik.uni-kl.de  
Track(s): 39  
2 sessions  
**Simulation applications in private and public organizations**  
*Invited*  
Banu Yuksel Ozkaya  
Hacettepe University  
byuksel@hacettepe.edu.tr  
Murat Caner Testik  
Hacettepe University  
mtestik@hacettepe.edu.tr  
Track(s): 41 44  
3 sessions  |
EURO 23 - Bonn 2009

STREAMS

Simulation based decision support
Invited
Miroljub Kljajic
University of Maribor
miroljub.kljajic@fov.uni-mb.si

Stig C Holmberg
Mid Sweden University
shbg@ieee.org
Track(s): 40
5 sessions

Simulation, metamodeling and optimization
Invited
Inci Batmaz
Middle East Technical University
ibatmaz@metu.edu.tr
Track(s): 37 38
2 sessions

Software for or/ms
Invited
Robert Fourer
Northwestern University
4er@iems.northwestern.edu

Bjarni Kristjansson
Maximal Software, Ltd.
bjarni@maximalsoftware.com
Track(s): 42
2 sessions

Stochastic modelling
Contributed
Horst W. Hamacher
University of Kaiserslautern
hamacher@mathematik.uni-kl.de
Track(s): 36
4 sessions

Stochastic modelling and simulation
Invited
Andreas Rößler
TU Darmstadt
roessler@mathematik.tu-darmstadt.de

Erik Kropat
Friedrich-Alexander University Erlangen-Nuremberg
ekropat@am2.am.uni-erlangen.de

Kuo-Hsiung Wang
National Chung-Hsing University
khwang@amath.nchu.edu.tw
Track(s): 36
3 sessions

Stochastic models for service operations
Invited
Ger Koole
VU University Amsterdam
koole@few.vu.nl

Sandjai Bhulai
VU University Amsterdam
sbhulai@few.vu.nl

Raik Stolletz
Leibniz University of Hannover
raik.stolletz@prod.uni-hannover.de
Track(s): 36
2 sessions

Stochastic programming
Invited
Jitka Dupacova
Charles Univ, Faculty of Math. and Physics
dupacova@karlin.mff.cuni.cz

Werner Römisch
Huboldt-University Berlin
romisch@math.hu-berlin.de

Alexander Shapiro
Georgia Institute of Technology
ashapiro@isye.gatech.edu

Rüdiger Schultz
University of Duisburg-Essen
schultz@math.uni-duisburg.de
Track(s): 12 13
14 sessions

Supply chain management
Invited
Herbert Meyr
Technical University of Darmstadt
Meyr@bwl.tu-darmstadt.de

Moritz Fleischmann
Rotterdam School of Management
MFleischmann@rsm.nl

Tamas Kis
Computer and Automation Research Institute
tamas.kis@sztaki.hu
Track(s): 8 9
14 sessions

Sustainable living: cognitive, social, economical, ecological and world view
Invited
Ali Gökmen
Middle East Technical University
agokmen@metu.edu.tr

Annette Hohenberger
Middle East Technical University (METU)
hohenberger@ii.metu.edu.tr

Gerhard-Wilhelm Weber
Middle East Technical University
gweber@metu.edu.tr

Inci Gökmen
Middle East Technical University
igokmen@metu.edu.tr
Track(s): 43
4 sessions

System dynamics modelling
Invited
Markus Schwaninger
Universität St.Gallen
markus.schwaninger@unisg.ch

Stefan Groesser
University of St. Gallen
stefan.groesser@web.de
Track(s): 43
3 sessions
Timetabling and rostering
Invited
Dario Landa-Silva
University of Nottingham
dario.landasilva@nottingham.ac.uk
Track(s): 9 10
9 sessions

Transportation
Invited
Maurizio Bielli
Institute of Systems Analysis and Informatics
bielli@iasi.cnr.it
Track(s): 3
3 sessions

Transportation planning
Invited
Herbert Kopfer
University of Bremen
kopfer@uni-bremen.de
Frank Schultmann
University of Siegen
frank.schultmann@uni-siegen.de
Track(s): 2 3
18 sessions

Uncertainty and environmental decision making
Invited
Jerzy Filar
University of South Australia
j.filar@unisa.edu.au
Alain Haurie
GERAD and ORDECSYS
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Track(s): 44
5 sessions

Value and risk in incomplete markets
Invited
Martin Rainer
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Track(s): 35
5 sessions

Variational inequalities and bi-level problems
Invited
Stephan Dempe
Technische Universitaet Freiberg
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Track(s): 38
5 sessions

Variational problems - theory, methods and applications
Invited
Rainer Tichatschke
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Technion - Israel Institute of Technology
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Xiaoqi Yang
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Özlem Birgul
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Track(s): 38
3 sessions

Vector and set-valued optimization
Invited
Vicente Novo
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Bienvenido Jiménez
Uned
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César Gutiérrez
Universidad de Valladolid
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Track(s): 10
3 sessions

Vehicle routing
Invited
Paolo Toth
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Track(s): 15
6 sessions

Workshops
Invited
Track(s): 28
1 session

Young people for system theory, optimization and education
Invited
Alexis Pasichny
National Technical University of Ukraine "Kyiv Polytechnic Institute"
alexis.pasichny@gmail.com
Kateryna Pereverza
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Alexander Makarenko
National Technical University of Ukraine "KPI"
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Track(s): 45
2 sessions
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