Three little octagons

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Abstract

Which octagon with unit diameter (or small octagon) has the largest area or the longest perimeter? Could it be the regular octagon? Well, no, this is not the case. We therefore invite the reader to a fascinating hunt for small octagons, an expedition which begins in 1922 with the work of Karl Reinhardt, continues in 1950 with the octagon of the mysterious wife of Stephen Vincze, regains vigor in 1975 when Ron Graham discovers the largest small hexagon and reaches success these last years, through conjunction of geometric methods with global optimization algorithms.

References

1. C. Audet, P. Hansen, B. Jaumard, G. Savard (2000). A branch and cut algorithm for nonconvex quadratically constrained quadratic programming. *Math. Program.* Ser. A, 87(1):131-152
2. C. Audet, P. Hansen, F. Messine, J. Xiong (2002). The largest small octagon. *J. Combinatorial Theory*, Ser. A, 98(1):46-59.
3. C. Audet, P. Hansen, F. Messine and S. Perron (2004). The minimum diameter octagon with unit-length sides: Vincze's wife's octagon is suboptimal. *J. Combinatorial Theory*, Ser. A 108:63-75.
4. C. Audet, P. Hansen, F. Messine (2007). The small octagon with longest perimeter. *J. of Combinatorial Theory*, Ser. A, 114(1):135-150.
5. C. Audet, P. Hansen and F. Messine (2007). Extreme problems for convex polygons, *Journal of Global Optimization*, 38, 163–179.
6. F. Messine (2004). Deterministic global optimization using interval contraint propagation techniques. *RAIRO Oper. Res.* 38(4):277-294.
7. F. Messine, J.L. Lagouanelle (1998). Enclosure methods for multivariate differentiable functions and application to global optimization. *J. Universal Computer Sci.*, 4(6), pp. 589-603.