D.c. programming approach to Malfatti's problem*

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We consider Malfatti's problem formulated 200 years ago. In 1803 Italian mathematician Malfatti posed the following problem: how to pack three non-overlapping circles of maximum total area in given triangle? In the beginning, Malfattis problem was supposed to be solved in a geometric construction way. Malfatti originally assumed that the solution to this problem are three circles inscribed in a triangle such that each circle tangent to other two and touches two sides of the triangle. Now it is well known that Malfatti's solution is not optimal. The most common methods used for finding the best solutions to Malfatti's problem were algebraic and geometric approaches. In 1994 Zalgaller and Los [1] showed that the greedy arrangement is the best one. There is still a conjecture about solving Malfattis problem for more than four circles by the greedy algorithm.

In [2,3] the problem has been formulated as the convex maximization problem over a nonconvex set and global optimality conditions by Strekalovsky [4] have been applied to this problem. In this talk, we formulate Malfatti's problem as D.C. programming problem with a nonconvex feasible set. For solving numerically Malfattis problem, we apply an algorithm [5], which converges locally. For a computational purpose, we consider some test problems. Computational results are provided.

References

1. Zalgaller V. A., Los' G.A.: The solution of Malfatti's problem. Journal of Mathematical Sciences,1994 ,Vol. 72, No. 4, P. 3163-3177.

2. Enkhbat R.: Global Optimization Approach to Malfatti's Problem. Journal of Global Optimization, Springer, New York, 2016, Vol. 65, No.1, P. 33-39.

3. Enkhbat R., Barkova M. V., Strekalovsky A. S.: Solving Malfatti's high dimensional problem by global optimization. Numerical Algebra, Control and Optimization, 2016, Vol. 6, No. 2, P. 153-160.

4. Strekalovsky A.S.: On the global extrema problem. Soviet Math. Doklad, 1987, Vol. 292, No.5, P. 1062-1066.

5. Strekalovsky A. S.: On local search in d.c. optimization problems. Applied Mathematics and Computation, 2015, Vol. 255, P.73-83.

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