On Local Search for General Optimization Problem with D.C. Constraints

Alexander Strekalovsky and Ilya Minarchenko

Matrosov Institute for System Dynamics and Control Theory of SB RAS,
Lermontov str., 134, 664033 Irkutsk, Russia
strekal@icc.ru, eq.progr@gmail.com
http://nonconvex.isc.irk.ru

The paper addresses a general nonconvex problem with the goal function and constraints given by d.c. functions [1].

This problem is reduced to a problem without constraints by the exact penalization approach [2]. Besides, the goal function of the penalized problem can be represented as a d.c. function.

Furthermore, the relations between the original problem and the penalized one are investigated.

In addition, using the linearization with respect to the basic nonconvexity of penalized problem, we develop a new local search method (LSM) [3] consisting in a consecutive solution of a sequence of linearized problems. Besides, some convergence properties of the method are established. In particular, it is shown that a limit point of the sequence produced by the method is a KKT point [4], but, in addition, it possesses some supplementary properties. Thus, such a limit point turns out to be rather stronger than the usual KKT vector.

Furthermore, the relations between an approximate solution to the linearized convex problem and the KKT vector of the original problem are investigated, and several stopping criteria are substantiated.

Besides, the relations among the Lagrange multipliers of the original problem, those ones of the linearized problem, and the value of the penalty parameter are established. Finally, a preliminary computational testing of the LSM developed has been carried out on several test problems taken from literature.

References

1. Strekalovsky, A.: On solving optimization problems with hidden nonconvex structures, in: T. Rassias, C. Floudas, S. Butenko (Eds.), Optimization in Science and Engineering, Springer, New York, 2014. P. 465–502.

2. Byrd, R., Nocedal, J., Waltz, R.: Steering exact penalty methods for nonlinear programming. Optimization Methods & Software 23 (2) (2008) 197–213.

3. Strekalovsky, A.: On local search in d.c. optimization problems. Applied Mathematics and Computation. 255 (2015) 73–83.

4. Nocedal, J., Wright, S.: Numerical Optimization, Springer, New York, 2006.