

Black-box global optimization: deterministic and metaheuristic approaches

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Global optimization problems are considered where the objective function is a continuous, non-differentiable, and multiextremal function satisfying the Lipschitz condition over a hyperinterval with an unknown Lipschitz constant. It is also supposed that the function is given by a black-box and its evaluation at a point is a time-consuming operation. Many algorithms for solving this problem have been discussed in literature [1–6]. Among them, deterministic global optimization methods form a well-developed group with many important applications [3–5]. One of their main practical advantages is the possibility to obtain guaranteed estimations of global solutions and to demonstrate (under certain analytical conditions) useful global convergence properties.

In this talk, some deterministic approaches [4, 5] developed by the authors to construct black-box global optimization methods are discussed and compared with several metaheuristic nature-inspired algorithms [1, 2]. Numerical comparison is performed on test classes and on some practical engineering problems with the usage of different criteria [4–6].

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References

- [1] C. A. Floudas and P. M. Pardalos (Eds.) *Encyclopedia of Optimization, in 6 volumes*, 2nd edn. Springer, Berlin, 2009.
- [2] P. M. Pardalos and H. E. Romeijn (Eds.) *Handbook of Global Optimization*, vol. 2. Kluwer, Dordrecht, 2002.
- [3] R. Paulavičius and J. Žilinskas. *Simplicial Global Optimization*. Springer, New York, 2014.
- [4] Ya. D. Sergeyev and D. E. Kvasov. *Diagonal Global Optimization Methods*. FizMatLit, Moscow, 2008. In Russian.
- [5] Ya. D. Sergeyev, R. G. Strongin, and D. Lera. *Introduction to Global Optimization Exploiting Space-Filling Curves*. Springer, New York, 2013.
- [6] A. A. Zhigljavsky and A. Žilinskas. *Stochastic Global Optimization*. Springer, New York, 2008.