

Solving Multiobjective Optimization Problems with Direct MultiSearch

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Abstract

In practical applications it is common to have to optimise several conflicting objective functions. Frequently, these functions are nondifferentiable or discontinuous, could be subject to numerical noise and, or be of black-box type, preventing the use of derivative-based techniques. An overview of some recent developments in derivative-free multiobjective optimisation will be presented. The basic concepts and ideas commonly considered in multiobjective optimization will be given. Direct MultiSearch (DMS) [1] is a solver for multiobjective optimization problems, without the use of derivatives and does not aggregate any components of the objective function. It essentially generalizes all direct-search methods of directional type from single to multiobjective optimization. DMS maintains a list of feasible nondominated points. At each iteration, the new feasible evaluated points are added to this list and the dominated ones are removed. Successful iterations correspond then to an iterate list changes, meaning that a new feasible nondominated point was found. Otherwise, the iteration is declared as unsuccessful. We provide a convergence analysis for the algorithm and report computational results, which show that our methodology has an impressive capability of generating the whole Pareto frontier even without using a search step. Applications of the DMS algorithm to real problems will be presented.

REFERENCES

- [1] A. L. Custódio, J. F. A. Madeira, A. I. F. Vaz, and L. N. Vicente. Direct multisearch for multiobjective optimization. *SIAM J. Optim.*, 21:1109–1140, 2011.