Multicriteria optimization technique based on local geometry of Pareto set

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We present an algorithm for nonlinear multicriteria constrained optimization which allows to find a single optimal solution or produce sufficiently dense set of Pareto optimal solutions covering the actual Pareto frontier. The underlying idea of the algorithm is to maximally avoid functions evaluations away from Pareto-frontier.

For the first task (finding single solution) it uses generalizations of steepest descent and quasi-Newton methods to the multi-objective case. For the whole Pareto frontier to be discovered it executes the following operations: starting with some optimal point, it makes step in design space along tangent to Pareto set and then push obtained (generically not optimal) point to optimality solving the first task. Repeating this procedure from the next optimal point it step-by-step discover the Pareto-frontier. Question of how to choose step length in order to cover Pareto-frontier uniformly is considered. Also, second-order local approximaltion of Pareto set is suggested to make steps more effective.

The algorithm is designed to efficiently solve engineering optimization problems where main difficulty is the expensiveness of objectives and constraints evaluations.

REFERENCES

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