

Progressive multi-objective optimization

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The multi-objective optimization paradigm prescribes that a decision maker should first generate a set of non-dominated solutions and then pick a solution from this set according to his/her preferences, using a multi-criteria method of his/her choice. In some situations, however, this approach is of limited practical use, mainly because of the fact that multi-criteria methods were not designed with the output of a typical multi-objective optimization algorithm in mind. Multi-objective optimization methods typically generate a large set of non-dominated solutions — in fact the quality of a multi-objective method depends partially on the cardinality of the Pareto set it generates — whereas multi-criteria methods were designed to compare only a handful of alternatives.

In Sörensen and Springael (2012) we introduced *progressive multi-objective optimization* (PMOO) that attempts to overcome the drawbacks of the multi-objective paradigm. PMOO is a novel technique that includes the decision maker's preferences into the multi-objective optimization process instead of tackling these steps sequentially.

PMOO integrates a method for multi-criteria decision making into a simple multi-objective metaheuristic by maintaining and updating a small reference archive of non-dominated solutions throughout the search. In this talk, we present a PMOO method for the multi-objective knapsack problem. This approach integrates the well-known PROMETHEE multi-criteria method into a simple tabu search method. By applying this novel technique to a set of instances of the multi-objective knapsack problem, the superiority of PMOO over the commonly accepted sequential approach of generating a Pareto set approximation first and selecting a single solution afterwards is demonstrated.

References

K. Sörensen and J. Springael. Progressive multi-objective optimization. *International Journal of Information Technology & Decision Making*, Accepted for publication, 2012.