Working Group 2: MCDA and RMO

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1 Focus

This working group focused on topics related to multiple criteria optimization and decision making, taking into account the principles of robust/reliable recommendations. The group discussed the meaning and the ways of implementation of the concepts of robustness and reliability in the context of multiple criteria decision analysis and that of single- or multi-objective optimization, with a particular attention to interactive methods of evolutionary multi-objective optimization.

2 Overview of State-of-the-art

Robustness is considered in many real world problems such as scheduling problems, routing and engineering design. In general, the robustness concerns are taking into account through distinction between deterministic decision variables, stochastic decision variables and external parameters. There are many methodologies which deal with robustness more or less explicitely. Classical approaches are in general related to the worst case scenario both in continuous and discrete case. However, there is a certain number of methodologies that deal with robustness without using this word, such as:

- stochastic programming,
- fuzzy possibilistic programming,
- multiobjective programming with interval and set-valued data,
- parametric multiobjective optimization,
- sensitivity, perturbation and stability analysis.

There are also some approaches taking into account a measure of robustness to be maximized.

Robustness regards also the acquisition and handling of subjective information with respct to preference information. The preference information can be direct (e.g. weights, tradeoffs, thresholds,...) or indirect, through some example of decisions. In case of direct information, robustness is taken into account considering several versions/scenarios of parameter values. In case of indirect information, robustness is taken into account considering the whole set of compatible preference models compatible with the preference information (for example the whole set of additive value functions compatible with a set of pairwise comparisons of represenative solutions supplied by the decision maker).

Dagstuhl Seminar Proceedings 09041
Hybrid and Robust Approaches to Multiobjective Optimization
http://drops.dagstuhl.de/opus/volltexte/2009/2002

3 Major Research Challenges

- Proper definition of robustness / reliability measures.
- Resolve uncertainty in single-objective optimization by means of a multiple criteria approach.
- Consider and develop the following bi-level optimization problem as a framework for finding robust efficient solutions: optimize a robustness measure on the set of Pareto efficient solutions.
- Propose methodologies for elicitation of preference information with the least possible cognitive effort from the decision-makers, permitting a robust interactive multi-objective optimization procedures taking into account uncertainty of performances in multi-objective context.

4 Potential Synergies between MCDM and EMO

- Collaboration on the definition of robustness;
- EMO as a versatile solution methodology for robust MCDM;
- integrate preference elicitation in EMO.

5 References and Keywords

- Stochastic programming;
- fuzzy possibilistic programming;
- multiobjective programming;
- parametric multiobjective optimization;
- sensitivity, perturbation, stability analysis;
- preference modelling;
- preference information;
- robustness measures.