Competence: Multiobjective Optimization

Research Group on Industrial Optimization

The Research Group on Industrial Optimization develops theory, methodology and computer implementations for solving real world decision making problems. Most of the research concentrates on **multiobjective optimization (MO)** in which multiple, conflicting objectives are optimized simultaneously and a **decision maker (DM)** is supported in finding a preferred compromise. Our group has active collaboration with experts in different application areas.

Strengths in Research

- **Interactive multiobjective optimization**
  - A human DM having expertize in the application area iteratively involved
  - Enables the DM to learn about the interdependences between the conflicting objectives considered
  - Reduces the number of solutions computed due to involvement of DM and his/her experience
- **Hybrid optimization approaches**
  - Combine benefits from both traditional and evolutionary optimization approaches
- **Handling computationally expensive optimization problems**
  - A very important challenge in practical simulation-based applications
  - Different approaches in utilizing surrogate models in MO
- **Research experience from theory to practical applications**
  - Software available for interactive MO methods
- **Methods and software are application-independent**

Successful Projects in Collaboration with Domain Specific Experts

Projects of applying interactive multiobjective optimization include:
- Anatomy-based three-dimensional HDR brachytherapy and BTE-based radiotherapy
- Dynamic process design
- Optimal shape design of a paper machine headbox
- Water allocation for a pulp and paper mill
- Forest management from both economic and environmental perspectives
- Wastewater treatment plant design and operation
- Control of chemical separation processes

Publications and Software

- Over **40 publications** in collaboration with international and national partners **in high-level international journals during the last five years** (2008-2012)
- **IND-NIMBUS®** software framework for industrial multiobjective optimization problems (http://ind-nimbus.it.jyu.fi)
- **WWW-NIMBUS** software freely available for academic use over the internet (http://nimbus.mit.jyu.fi/)

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