Dagstuhl Seminar 20031
Scalability in Multiobjective Optimization

With the ongoing production of big amounts of data and increasing computational power, we have recently experienced a shift of paradigm from decision-making problems with relatively few variables and constraints, and two or three objective functions, towards large-scale problems involving many variables, many objective functions and constraints, and many decision makers. In view of these growing practical needs, the scalability of models and solution approaches, as a decisive characteristic for future applicability and success of multiobjective optimization, has thus become a crucial issue for two main research communities, Evolutionary Multicriterion Optimization (EMO) and Multi-Criterion Decision Making (MCDM). In this seminar, we will focus on three main aspects of scalability in multiobjective optimization and their interplay, namely

(1) MO with many objective functions,

(2) MO with many decision makers, and

(3) MO with computationally heavy objectives, many variables and/or large amounts of data.

During the seminar, we intend to achieve the following goals by combining EMO and MCDM perspectives and tools:

(a) Understand why current approaches in multiobjective optimization do not usually scale well with (i) an increasing number of objectives, (ii) an increasing number of decision makers, and (iii) an increasing number of variables and data,

(b) Jointly identify novel strategies for model building, solution algorithms, preference modelling, testing and validation that are capable of handling large-scale problems, and

(c) Initiate collaborative projects for implementing scalable approaches in challenging real-world decision-making situations.

Program – Monday, January 13, 2020

09:00 – 10:30: Welcome Session
- Welcome and Introduction
- Short presentation of all participants (2 minutes each!)

Coffee Break

11:00 – 12:00: Challenges in Models
- Dimo Brockhoff, Michael Emmerich, Boris Naujoks & Robin Purshouse: MACODA – A Lorentz Center Workshop on "MAny Criteria Optimization and Decision Analysis"
- Arnaud Liefooghe: On the Difficulty of Multiobjective Combinatorial Optimization Problems

Lunch

14:00 – 15:00: Challenges in Methodology
- Mickaël Binois: Scaling up Multi-Objective Bayesian Optimization
- Sanaz Mostaghim: Recent Advances in Multi-Objective Large Scale Optimisation

15:00 – 15:30: Group Discussion

Coffee Break

16:00 – 16:30: Working Group Formation

16:30 – 18:00: Working Groups

Dinner

19:30: Opening of the art exhibit "Das Loch das von der anderen Seite kam"
   by the German artist Lola Sprenger

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Program – Tuesday, January 14, 2020

09:00 – 09:30: Many Objectives in Stochastic Settings   Chair: Heike Trautmann
 - Susan Hunter: Multi-Objective Simulation Optimization: Theory and Practice

09:30 – 10:30: Reporting from Working Groups and Splitting into Smaller Groups

Coffee Break

11:00 – 12:00: Many Objectives in Deterministic Settings   Chair: Christiane Tammer
 - Anita Schöbel: Robust Multiobjective Optimization Problems – An Approach with Very Many Objective Functions
 - Gabriele Eichfelder: A Multiobjective Trust Region Method for Expensive and Cheap Functions

Lunch

14:00 – 15:30: Small Working Groups

Coffee Break

16:00 – 17:00: Small Working Groups

17:00 – 18:00: Reporting from Small Working Groups
 - General discussion and working group adaptations

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Program – Wednesday, January 15, 2020

09:00 – 09:30: Problems with Many Variables   Chair: Patrick M. Reed
 - Georges Fadel: Multi-Objective Topology Design of Functionally Graded Components

09:30 – 10:30: Small Working Groups

Coffee Break

11:00 – 12:00: Small Working Groups

Lunch

14:00: Group Photo (Outside)

14:05 – 15:30: Hiking Trip

Coffee Break

16:00 – 17:00: Small Working Groups

17:00 – 18:00: Participant Announcements

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Program – Thursday, January 16, 2020

09:00 – 10:30: Future Directions   Chair: Jürgen Branke
- Fritz Bökler: Complexity in Multiobjective Optimization
- Dimo Brockhoff: On Set-Indicator-Based Search: Using Single-Objective Solvers for Multiobjective Problems
- Pascal Kerschke: Chances and Challenges of Multimodality in Multi-Objective Continuous Optimization Problems

10:30 – 11:00: Coffee Break

11:00 – 12:00: State of Play

Lunch

Time for Individual Discussions (e.g. Offers-and-Needs Market)

15:30 – 16:00: Coffee Break

16:00 – 18:00: Small Working Groups

Dinner

20:00 Wine-and-Cheese Party (Music room)

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Program – Friday, January 17, 2020

09:00 – 10:30: Final Reporting from Working Groups

10:30 – 11:00: Coffee Break

11:00 – 12:00: Closing Session

Lunch