



MACSI Workshop

Topology Optimization Days

The State-of-the-Art in Theory, Software, and Applications

Location: Wissenschaftszentrum Schloß Thurnau, Germany

Date: September 18 to 19, 2003

Organizer: [Prof. K. Schittkowski](#), Department of Mathematics, [University of Bayreuth](#)
German-Israeli Minerva School on [Modern Optimization and its Application in Engineering II](#)

see also: [II](#)



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Aims and Scopes:

Topology optimization generates the optimal shape of a mechanical structure. The structural shape is generated within a pre-defined design space. In addition, the user provides structural supports and loads. Without any further decisions and guidance of the user, the method will form the structural shape thus providing a first idea of an efficient geometry. Therefore, topology optimization is a much more flexible design tool than classical structural shape optimization, where only a selected part of the boundary is varied without any chance to generate a lightness hole, for example. A given amount of structural mass is used to maximize a desired property of the structure, usually stiffness or lowest eigenfrequency. Vice versa, we could also minimize the amount of structural mass (weight) subject to a given behaviour measure.

To represent the mass distribution respectively the form of the structure and at the same time the structural behaviour, the design space is discretized by the finite element method. Besides the basic approach to generate two- or three-dimensional solid structures, there are meanwhile numerous variants, for example the generation of ribs for plates and shells or the topology optimization of trusses.

The goal of the seminar is to present efficient methods for structural topology optimization using FEM analysis. Participants will be guided from the basic mathematical theory to up-to-date numerical algorithms and practical applications. The seminar will indicate new trends and modelling techniques as well as information on practical application problems that are solvable at present. To achieve these goals, high-level scientists are invited belonging to the founders of modern topology optimization, but also software specialists and experienced engineers from industry.

The topics to be addressed during the workshop are

1. **Introduction**
 - historical background
 - FE structural analysis
 - optimal material distribution and material properties
 - homogenization and energy methods
2. **New trends in topology optimization**
 - optimization model
 - model approximations
 - multi-physics and nonlinear problems
 - large scale optimization
3. **Software and industrial applications**
 - implementation aspects
 - link to CAD and FE discretization
 - pre- and postprocessing
 - industrial case studies, e.g., from automotive industry
 - manufacturing constraints
 - software demonstrations

Intended Audience:

The seminar is directed to engineers and scientific staff members from industry and public research organisations wanting to become familiar with modern structural design methods and especially topology optimization. Basic knowledge of discretization methods (FEM), integrals, and matrix algebra is desirable.

The seminar might be of interest also for insiders of structural optimisation and decision makers, who want to be informed about new trends and modern developments for their own needs.

Lecturers (preliminary list):

[Prof. M. Bendsoe](#) [Department of Mathematics, Technical University of Lyngby, Denmark](#)
 Dr. L. Harzheim [Adam Opel AG, Rüsselsheim](#)
[Dr.-Ing. H.-P. Mlejnek](#) [Institute of Statics and Dynamics of Air- and Space Constructions \(ISD\), University of Stuttgart](#)
 Dipl.-Ing. P. Allinger [FE-Design, Karlsruhe](#)
 Dr.habil. U. Schramm [Altair Engineering, Troy, USA](#)
 Dipl.-Math. F. Vogel [inuTech GmbH, Nürnberg](#)

Preliminary Program:

		Thursday, September 18
10:30-10:35	Schittkowski	Welcome Address

10:35-12:00	Mlejnek	Finite Elements and Optimal Material Distribution - Basics and Introduction
12:00-13:30	lunch break	
13:30-15:00	Bendsoe	Topology Design of Continuum Structures - Basic Concept and New Applications
15:00-15:30	coffee break	
15:30-17:00	Vogel	Issues on Large Scale Structural Optimization with Applications in Industry
17:00-18:00	participants	Short Presentations and Discussions
18:00-20:00	dinner	
20:00 - ...	welcome party	

Friday, September 19		
8:30-10:00	Schramm	Manufacturing and Topology Optimization
10:00-10:30	coffee break	
10:30-12:00	Allinger	Topology Optimization of Industrial Problems with Manufacturing Restrictions
12:00-13:30	lunch break	
13:30-15:00	Harzheim	Application of Topology Optimization in the Chassis Area
15:00-16:00	participants	Final Discussion

Seminar Language:

English and/or German depending on the audience.

Accommodation:

The seminar will take place at the [Wissenschaftszentrum Schloß Thurnau](#). [Thurnau](#) is a small, historical city about 30 km in the west of Bayreuth. Participants will stay overnight either in the castle or in nearby hotels. All lectures, meals, and social events will take place in the castle.

Travel Information:

Arrival by car: Thurnau is close to the Autobahn (A70) between [Bayreuth](#) and [Bamberg](#). Take any of the two exits. The castle is located in the middle of the town, you cannot miss it.

Arrival by train in Nürnberg:

1. The actual train schedule and connections from Nürnberg to Bayreuth can be retrieved from [internet](#).
2. Change your train in Nürnberg. If you are lucky, you can reach another Intercity Train (ICE) to Bayreuth starting at platform no. 15. Otherwise, take a local train (Regionalbahn) starting from platform no. 17 (appr. 15 min to full hour). Please check platform number to be sure. Enter the first part of the train. In some cases, the train is separated at an intermediate station.
3. Travelling time is about 1 h.
4. Take a taxi to Thurnau.

Registration:

To register, send an e-mail to the local organizer, [Prof. K. Schittkowski](#), containing the following information:

1. Full name and address with phone/fax number
2. Arrival and departure data (for room reservation)

Important Notes:

- i. The number of participants is limited, early registration is recommended.
- ii. Accommodation in [Wissenschaftszentrum Schloß Thurnau](#), if possible, for EUR 45 per night including taxes and breakfast, or in nearby hotels for about the same rate, to be paid directly at the hotel.
- iii. Participation fee for lecture notes, refreshments, and three meals is **EUR 80**, to be paid in advance or by cash on arrival.

Acknowledgement:

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