Graduate course

Structural optimization: algorithms and applications

May 24th and May 27th 2019

Delft University of Technology
Eindhoven University of Technology

General

The two-day course provides an overview of several popular optimization techniques, with particular focus on optimization methods for structural optimization applications. The first day of the course presents the general techniques of gradient-based optimization and optimization using surrogate models. The second day considers finite-element-based optimization, with particular focus on the calculation of design sensitivities and structural topology optimization.

The course has an informal character with ample opportunity for discussions with the lecturers and other participants.

Local organization

The course is hosted jointly by Eindhoven University of Technology and Delft University of Technology. The organizing committee is composed of

- Dr. L.F.P. Etman (Eindhoven University of Technology)
- Dr. M. Langelaar (Delft University of Technology)

Lecturers

- Dr. L.F.P. Etman (Eindhoven University of Technology)
- Dr. H.J.M. Geijselaers (University of Twente)
- Dr. M. Langelaar (Delft University of Technology)

Lecture notes

Lecture notes and course material will be distributed digitally at the start of the course.

Prerequisites

Participation in the course is facilitated by basic familiarity with:

- Calculus and linear algebra;
- Continuum mechanics;
- Numerical techniques (notably, finite-element methods);
- Matlab (for exercises).

Contents

The course is hosted by Eindhoven University of Technology on Friday May 24th and by Delft University of Technology on Monday May 27th. The course consists of lectures and some computer-practical sessions. The course covers the following topics:

1) *Basic principles and gradient-based optimization*
   Introduction, optimization problem formulation, conditions for optimality, concepts of gradient-based optimization methods, line search methods, trust region methods, methods in structural optimization.
2) *Surrogate modeling*
   Concepts of surrogate modeling, response surface modeling, radial basis functions, with applications to optimization.
3) *Structural sensitivity analysis*
   Approaches, finite difference gradients, semi-analytic derivatives, adjoint formulation, continuum derivatives.
4) *Structural topology optimization*
   Sensitivity analysis, topology optimization concepts, SIMP method, level set method, applications of topology optimization.

Fee/Registration

The course is free for registered members of the graduate school Engineering Mechanics and for the research members of the contributing research groups. The course fee for non EM members is € 100 for students and € 400 for other participants. They will receive an invoice after accepted registration. Participants need to register by completing the registration form, which can be found at http://www.em.tue.nl/events/index.php/2/2019 and returning it **before May 7th, 2019** to the Secretariat of the Graduate School Engineering Mechanics, Eindhoven University of Technology. Members of the Graduate School Engineering Mechanics receive priority in case of over-subscription.

Further information

Both course days start at 10.00 hour and end around 17.00 hour. Lunch is included.
Please bring your own laptop with Matlab installed.

If you do not have a laptop, or for more information about the contents of the course, please contact:

Matthijs Langelaar, TU Delft
E-mail: m.langelaar@tudelft.nl

Further information about the educational programme and other activities of the Graduate School on Engineering Mechanics can be found at: www.em.tue.nl.