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Division of Solid Mechanics
Linköping University

2018–10–15

Course information for:
Structural Optimization (TMMS 20), 2018

Course secretary: Anna Wahlund, anna.wahlund@liu.se, tel. 013–281157

Examiner: Carl-Johan Thore, carl-johan.thore@liu.se

Lecturers: Carl-Johan Thore (CJT) and Peter Christensen (PC), peter.christensen@liu.se

Computer project assistant: Jan–Lucas Gade, jan-lucas.gade@liu.se

Literature

1. P.W. Christensen and A. Klarbring, *An introduction to structural optimization*, Springer, 2009 (available at Bokakademin)
2. A. Klarbring and J. Petersson, *Strukturoptimering*, (non-compulsory text, in Swedish, 14 pages elementary text, download at the course home page)
3. P. Christensen , *Computer project in structural optimization: sizing optimization using MATLAB*, (download at the course home page)
4. P. Christensen, *Computer project in structural optimization: shape optimization using TRINITAS*, (download at the course home page)
5. C.-J. Thore and J. Petersson, *Computer project in structural optimization: topology optimization using TRINITAS and MATLAB*, (download at the course home page)
6. T. Borrvall and J. Petersson, *Three-Dimensional shape and topology optimization in Cauchy-Navier's PDE*, (non-compulsory text, slides containing mainly optimal design pictures, download at the course home page)

Old examinations, including solutions, are available on the course home page.

Lecture and lesson schedule

Each occasion takes 2×45 minutes, and is either a lecture (F) or a lesson (L).

Occasion	F/L	Covers
1	F	Introduction and terminology. (CJT)
2	L	Exercises: minimize weight subject to constraints on stress. (CJT)
3	L	Exercises: minimize weight subject to constraints on stress and displacements, or constraints on stress and instability. (CJT)
4	F	Convexity, Lagrange duality in structural optimization I. (PC)
5	F	Lagrange duality in structural optimization II. (PC)
6	L	Exercises on the above. (PC)
7	F	Formulations, sequential explicit approximation (SEA). (PC)
8	F	SEA: CONLIN and MMA. (PC)
9	F	Example of the overall procedure. (PC)
10	F	Sensitivity analysis I. (PC)
11	F	Sensitivity analysis II. (PC)
12	F	Shape optimization. (PC)
13	F	Calculus of variations and optimization in equilibrium principles. (CJT)
14	L	Exercises on the above. (CJT)
15	F	Maximum stiffness: theory. (CJT)
16	L	Maximum stiffness: exercises I. (CJT)
17	L	Maximum stiffness: exercises II. (CJT)
18	F	Topology optimization (TO): variable thickness sheet problem. (CJT)
19	F	TO: OC-method and SIMP-penalization. (CJT)
20	F	Course closure. (CJT)

Computer project schedule

One computer exercise occasion takes 2×45 minutes. The total number of computer exercise occasions is four.

1. **Sizing optimization** with MATLAB, computer exercise 1. Prepare by reading item 3 in the literature list.
2. **Shape optimization** with TRINITAS, computer exercise 2. Prepare by reading item 4 in the literature list.
3. **Topology optimization** with TRINITAS and MATLAB, computer exercise 3 – 4. Prepare by reading item 5 in the literature list.

The computer exercises will be given in the computer lab Folkvang 1–2 (A-building, upstairs, C-corridor, between entrances A13 and A15).

Examination

Written examination, total 16 points. Problems are both of theory and problem solving nature. Permissible aids: a calculator (with memory erased). Minimum points for pass is 6.

- grade 3: 6 – 8 points,
- grade 4: 9 – 11 points,
- grade 5: 12 – 16 points.

In addition to the written examination, three reports – one for each computer project – have to be written and handed in to the assistant. Deadlines:

Exercise 1: Monday, December 3rd,

Exercise 2: Monday, December 10th,

Exercise 3: Monday, January 7th.