LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Strukturoptimering
Structural Optimization

FHLN01, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED M
Date of Decision: 2023-04-11

General Information

Elective for: BME5, F4, F4-bem, M4-pu, M4-bem, M4-tt, MD4, Pi4-bem
Language of instruction: The course will be given in English

Aim

In stuctural optimization the problem of finding the 'optimal' design is considered. The term 'optimal' design can apply to various aspects and the common features are minimum weight or maximum stiffness of a structure. The course is aimed to give the student knowledge and fundamental understanding of modern tools that are commercially available.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to explain and understand goal function, constraints, global and local minima
- be able to explain and understand the underlying optimization algorithms used in structural optimization
- be able to explain and identify the causes for numerical instabilities associated with numerical topology optimization

Competences and skills
For a passing grade the student must

- be able to formulate a mathematical optimization problem from engineering structural optimization problems.
- be able to describe numerical solution strategies suitable for structural optimization.

Judgement and approach
For a passing grade the student must

- be able to solve simple discrete structural optimization problems analytically
- be able to solve simple continual stiffness optimization problems using variational principles.
- implement simple optimization algorithms in a finite element environment

Contents

The following topics will be considered in the course

- Formulation of optimization problems, goal functions, constraints, global/local optima.
- Convex optimization
- Convex approximation techniques for structural optimization problems
- Size and shape optimization
- Topology optimization
- Filter

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Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: The examination of the course consists of one assignment and one mid-term exam.The final mark will be based on the results from both parts. The assignment will be marked with failed or passed with grades from 15-30. The mid-term examination will be marked with failed or passed with grades from 15-30. The final mark will be based on the grades divided with 10. Less than 3.0 points is failed, 3.0 - 3,9 will give the mark 3, 4,0 - 4,9 will give the mark 4 and 5,0 and more will give the mark 5.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts
Code: 0112. **Name:** Project.
Credits: 4,5. **Grading scale:** UG. **Assessment:** The assignment will be marked with failed or passed with grades from 15-30. The assignment can only be made during the course but if marked with failed the student will be given the possibility to correct the assignment.
Code: 0212. **Name:** Mid-term Exam.
Credits: 3. **Grading scale:** UG. **Assessment:** The written mid-term examination will be marked with failed or passed with grades from 15-30. The mid term examination can only be made during the course but if marked with failed there will be given an extra mid-term exam about two weeks after the regular one.

Admission

Assumed prior knowledge: FHLF20/FHL064, FHLF01 Finite Element Method or similar course.
The number of participants is limited to: No

Reading list

- An introduction to structural optimization,.
- Christensen, P and Klarbring, A.
- Springer-Verlag, 2008.
- ISBN: 978-1-4020-8665-6.
- CALFEM - A finite element toolbox to MATLAB. Studentlitteratur.

Contact and other information

Course coordinator: Docent Mathias Wallin, Mathias.Wallin@solid.lth.se
Course homepage: http://www.solid.lth.se