Structural Optimization

Programme course

6 credits

Strukturoptimering

TMMS20

Valid from: 2017 Spring semester

Determined by
Board of Studies for Mechanical Engineering and Design

Date determined
2017-01-25

Main field of study
Mechanical Engineering

Course level
Second cycle

Advancement level
A1X

Course offered for
- Industrial Engineering and Management - International, M Sc in Engineering
- Industrial Engineering and Management, M Sc in Engineering
- Mechanical Engineering, M Sc in Engineering
- Mechanical Engineering, Master's programme

Entry requirements
Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites
Basic courses in solid mechanics. Preferably a basic course in optimization.

Intended learning outcomes
In structural optimization we study the problem of finding the best mechanical design. The word "best" has to be given a certain meaning, it could be to minimize the structural weight or to maximize the stiffness. The course aims at giving knowledge and understanding of how such maximum efficient load-carrying structures may be obtained, and skill in using the corresponding computer based tools. After the course the students should be able to

- Formulate engineering design problems for load carrying structures as optimization problems, using both size, shape and topological variables.
- Solve small-scale discrete problems.
- Describe numerical algorithms suitable for structural optimization problems.
- Solve some continuous structural optimization problems using calculus of variations.
- Use and describe the general steps involved in solving large scale shape and topology optimization problems.

Course content
Basic concepts. Classification of structural optimization problems. Lagrangian duality. Calculus of variations and energy principles in solid mechanics. Explicit approximations: SLP, SQP, CONLIN, OC, MMA. Sensitivity analysis. Shape optimization. Structures of maximum stiffness and topology optimization. The SIMP-method. Computer exercises on shape and topology optimization will be performed with the FEM program TRINITAS.

Teaching and working methods
Lectures, lessons and computer exercises.

Examination

UPG1	Laboratory Work	1.5 credits	U, G
TEN1	Written Examination	4.5 credits	U, 3, 4, 5

Grades
Four-grade scale, LiU, U, 3, 4, 5

Other information
Supplementary courses: Project course in Mechanical Engineering Systems, Solid Mechanics and Machine Design.

Department
Institutionen för ekonomisk och industriell utveckling

Director of Studies or equivalent
Peter Schmidt

Examiner
Anders Klarbring

Course website and other links

Education components
Preliminary scheduled hours: 48 h
Recommended self-study hours: 112 h

Course literature

Additional literature

Books

P.W. Christensen and A. Klarbring, (2009) *An Introduction to Structural Optimization*

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.