Design Optimization

Programme course

6 credits

Konstruktionsoptimering

TMKT48

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
- Design and Product Development
- 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
Introductory courses in mathematics, mechanics, solid mechanics and mechanical engineering design.

Intended learning outcomes

The course aims at integrating traditional design methodologies with concepts and techniques of modern optimisation theory and practice. In the course the student will learn to create an appropriate mathematical description (a simulation model) of the design problem, to formulate the optimisation problem and finally to use numerical optimisation techniques and computer support tools in order to solve the problem. After the course the student:

- Should understand and be able to describe the function of a set of iterative optimization methods such as Genetic Algorithms, the Complex Method, and gradient methods (Newton methods)
- Should be able to compare and evaluate the suitability of different optimization methods for different problem types.
- Should be able to formulate design problems as mathematical optimization problems.
- Should be able to implement mathematical models of design problems in MATLAB and solve them using numerical optimization methods.
- Should be able to describe how simulation and optimization could be connected.
- Should be able to implement the connection between simulation and optimization in the MATLAB/Simulink environment.
- Should be able to analyze the sensitivity of the obtain optimal solutions.
- Should be able to discuss the plausibility of the results.

Course content

Optimization in the desing process
Optimization methods: Genetic Algorithms, the Complex method, gradient based methods
Formulation of design problems as optimization problems
Formulation of objective functions
Optimization based on simulation models
Multi-objective optimization
Constraints and penalty functions
Post optimal analysis
Sensitivity analysis

Teaching and working methods

Lectures, seminars, computer exercises where the methods and techniques thought in the course are applied to real design tasks.

Examination

UPG1	Design task	1 credits	U, G
DAT1	Written examination	5 credits	U, 3, 4, 5

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

Department
Institutionen för ekonomisk och industriell utveckling

Director of Studies or equivalent
Peter Hallberg

Examiner
Johan Ölvander

Course website and other links

Education components
Preliminary scheduled hours: 70 h
Recommended self-study hours: 90 h

Course literature
Kompendium och vetenskapliga artiklar.

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.