Optimization of Realistic Complex Systems

Programme course

6 credits

Optimering av realistiska, sammansatta system

TAOP61

Valid from: 2017 Spring semester

Determined by
Board of Studies for Mechanical Engineering and Design

Date determined
2017-01-25

Main field of study
Mathematics, Applied Mathematics

Course level
Second cycle

Advancement level
A1X

Course offered for
- Energy-Environment-Management
- Computer Science and Engineering, M Sc in Engineering
- Chemical Biology
- Engineering Biology, M Sc in Engineering
- Mathematics, Master's programme
- Information Technology, M Sc in Engineering
- Computer Science and Software Engineering, M Sc in Engineering

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
Optimization for engineers (or similar basic course in optimization).
programming in Matlab.

Intended learning outcomes

The course treats mathematical tools for formulation and solving of optimization problems for realistic complex systems, including environment and energy aspects. Both advanced model formulation and choice of solution method based on the problem structure are included.
Methods used are heuristics and decomposition methods.

After finished course, the student shall be able to:
Formulate complicated optimization problems as mathematical models.
Identify structures in complex model formulations.
Choose suitable solution method based on the problem structure, and motivate the choice.
Explain the principles behind certain heuristic solution methods and decomposition methods, and use them to solve problems.
Plan, develope and realize certain advanced solution techniques for complex optimization problems.
Use general and specialized software for optimization.
Present results orally and in writing.

Course content

Advanced model formulation, metaheuristics, heuristics for combinatorical problems, methods for expensive objective functions, decomposition methods based on Lagrange relaxation. Examples of formulations containing environment and energy aspects.

Teaching and working methods

The course is given as lectures, lessons and project work. The lectures treat theory, solution methods and principles of modeling. The lessons
contain exercises in model formulation and problem solving. The project work contains model formulation, implementation of optimization algorithms, solution of optimization problems with self-made or available software, and presentation of the results.

Examination

PRA1	Project work	3 credits	U, G
TEN1	Written examination	3 credits	U, 3, 4, 5

Grades

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

Department

Matematiska institutionen

Director of Studies or equivalent
Ingegerd Skoglund

Examiner
Kaj Holmberg

Course website and other links
http://courses.mai.liu.se/GU/TAOP61

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

Course literature
Kaj Holmberg: Optimering (Liber 2010). Kaj Holmberg: Kompletterande material, 2014.

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.