Collaborative Multidisciplinary Design Optimization

Programme course

6 credits

Kollaborativ multidisciplinär designoptimering

TMKT79

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
- 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.

Intended learning outcomes

The goal is mainly to introduce an integrated modeling approach, which is then used to automatically search through the design space with suitable optimization algorithms. After completing this course, the participants will have a good understanding of how practical design automation and optimization can be setup in a product development process. The ultimate aims is finding optimal solution and still reduce the current time to market by applying a more efficient product development process.

After completion of the course the students shall:

- be capable of creating geometric centric design frameworks in various CAD tools such as CATIA V5, SolidWorks and Creo.
- use a modular driven modeling methodology in order to create automated design frameworks, which can be more easily enhanced and modified. The modular methods will be applied on mainly CAD, FEM and Dynamic models.
- be able to use various tools in order to establish integration between the models.
  be capable of creating numerical efficient surrogate models in order to reduce the simulation time and thus making an optimization more practical.
- understand how different algorithms should be utilized in different engineering problems involving multiple disciplines.
- understand how a complex problem should be formally stated with multiple objectives and constraints.
- be able to discuss the plausibility of the results

Course content

The Collaborative Multidisciplinary Design Optimization (CMDO) course focuses on tools and methods for model based engineering and optimization within the machine design field.

The course is divided in two parts. In the first part of the course the students are introduced to modeling and simulation procedures as well surrogate modeling and optimization strategies

In the second part of the course the students are introduced to an examination task, which should be solved in groups. Furthermore the content of the course is listed as follows:

- Multidisciplinary Optimization in the design process using tools such as MATLAB and ModeFRONTIER
- Formulation of design problems as optimization problems
- Geometric Modeling using tools such as CATIA V5, SolidWorks and Creo
- Surrogate Modeling in MATLAB and ModeFRONTIER
- FEM and CFD modeling using Ansys
- Dynamic Modeling with Simulink and Dymola
- Model integration using software such as MATLAB, Excel and ModeFRONTIER

Teaching and working methods

Lectures and computer exercises where methods and techniques thought in the course are applied to real design tasks. The lectures consist of mixed theory overview as well as guest lecturers from the industry to put the theory in a real world context.

Examination

UPG1	Assignment	6 credits	U, 3, 4, 5

In the examination project students are working in groups. Upon completion of the project, the student will present their project during an oral examination. During the examination individual questions are asked, and individual exercises may be handed out

Grades

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

Department

Institutionen för ekonomisk och industriell utveckling

Director of Studies or equivalent

Petter Hallberg

Examiner

Mehdi Tarkian

Course website and other links

Education components

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

Course literature

Additional literature

Articles

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.