Introduction to Computational Mechanics

Programme course

6 credits

Introduktion till beräkningsmekanik

TMHL63

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
First cycle

Advancement level
G2X

Course offered for
- Aeronautical Engineering, Master's Programme
- Mechanical Engineering, Master's Programme
- Mechanical Engineering, M Sc in Engineering
- Design and Product Development
- Industrial Engineering and Management - International, M Sc in Engineering
- Industrial Engineering and Management, 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
Linear algebra, multi-variable calculus and basic courses in engineering mechanics, solid mechanics, heat conduction, fluid mechanics and engineering materials

Intended learning outcomes

The course aims at giving the student

- an insight into the use of computational techniques in applied mechanics
- an insight into how technical computations are used in the design process
- a basic theoretical understanding of the completely dominating computational method, namely the Finite Element Method/FEM
- the ability to independently solve not too advanced problems by using a well known commercial FE software

It is to be noted that the focus in the course will be placed more on the applications of the Finite Element Method than on its theoretical details. The application fields that will mainly be discussed in the course are static solid mechanics and stationary heat conduction. Furthermore, an orientation regarding the use of FEM in other application fields such as transient dynamics, structural optimisation, material mechanics, fluid mechanics and heat transfer will also be given. The evaluation of results including material-related aspects will be a standing issue in the course. At the end of the course, the student shall be able to

- give an account of how computations are used in the design process
- give an account of the theoretical basis of FEM
- give an account of the inherent structure of an FE program
- give an account of potential sources of error associated with FE analyses
- use a well known FE software to solve not too advanced problems
- give an account of the importance of result evaluation with respect to e.g. material aspects

Course content

- Introduction into the use of computational techniques in applied mechanics
- Stress analysis of 2-dimensional rod structures/trusses (with the direct stiffness method); applications, basic relations, matrix problem formulation, laboratory work
- Linear elastic stress analysis of 2- and 3-dimensional solid bodies; applications, basic relations, FE formulation, laboratory work
- One- and multi-dimensional heat conduction analysis; applications, basic relations, FE formulation, laboratory work
- Orientation regarding other application fields for FEM such as transient dynamics, structural optimisation, material mechanics, fluid mechanics and heat transfer, including laboratory work
- Evaluation of results including material-related questions (standing issue in the course)

Teaching and working methods

Lectures, teaching classes and laboratory work

Examination

LAB2	Mandatory assignments	3 credits	U, G
TEN1	Written examination	3 credits	U, 3, 4, 5

For higher degree than 3 optional laboratory assignments has to be done.

Grades

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

Other information

Supplementary courses: Advanced courses in the field of applied mechanics (engineering mechanics, solid mechanics, heat conduction, fluid mechanics and engineering materials).

Department

Institutionen för ekonomisk och industriell utveckling

Director of Studies or equivalent

Peter Schmidt

Examiner

Kjell Simsonsson

Course website and other links

http://www.solid.iei.liu.se/Education/

Education components

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

Course literature

Fastställs senare

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.