SE2860 FEM Modelling 8.0 credits

Modellering i FEM

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for SE2860 valid from Autumn 2017

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Mechanical Engineering

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

The finite element method (FEM) is a powerful tool for solving PDE problems in engineering. This course focuses on the modelling aspects of FEM with the emphasis on structural mechanics problems. Non-trivial loading will be considered in the sense that the loading itself may depend on the solution of other problems of physics. For instance, if the deformation in a solid depends on heat flow, a heat conduction problem must be solved, or if it depends on the normal and shear tractions caused by a flowing fluid, a fluid mechanics problem must be solved. Solving these may be done in a separate step or in a manner fully coupled to the structural mechanics problem. These kinds of problems are often referred to as multiphysics problems. The course aims at expanding and improving the participants' abilities and skills in technical modelling of complex engineering multiphysics problems by use of FEM.

After the course, the participants should be able to:

- Identify the physical phenomena that need to be considered in order to solve a specific engineering problem.
- Formulate an appropriate discretized geometrical model that can be solved by FEM.
- Choose a material model, or models, that capture the key features in the application.
- Formulate relevant initial and boundary conditions, respectively, for a given multiphyics problem.
- Correctly analyse the outcome of the FEM simulation.
- Describe and present the engineering problem that has been analysed, its mathematical formulation, the FEM model used to solve the problem and the results in a well-structured technical report.

Course contents

The course consists of a series of lectures, computer labs and tutorials, which will give the theoretical background to the coupled physics phenomena to be considered as well as the practical modelling aspects of them. However, most time will be spent on four simulation exercises, which will give the participants comprehensive training in how to solve a multiphysics problem related to structural mechanics.

Specific prerequisites

Basic undergraduate course in Solid mechanics SE1010, SE1020, SE1055 or Structural mechanics SG1801 or the equivalent
and
basic course on FEM theory and FEM usage, SE1025 or the equivalent.

Course literature

Handouts.

Reference literature:

R. D. Cooks, D. S. Malkus, M. E. Plesha & R. J. Witt, Concepts and Applications of Finite Element Analysis, 4th Ed., Wiley, New York, 2002.

Examination

- PROA - Project, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- ÖVNA - Exercises, 5.0 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Other requirements for final grade

Passed Project assignment (PROA; 3 credit)
Passed Simulation exercises (ÖVNA; 5 credits)

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.