SE2135 Fatigue, Reliability and Design 9.0 credits

Utmattning, tillförlitlighet och dimensionering

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 SE2135 valid from Autumn 2011

Grading scale

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

Education cycle

Second cycle

Main field of study

Technology

Language of instruction

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

Intended learning outcomes

FRD - FATIGUE, RELIABILITY AND DESIGN

This course educates computational engineers that contribute to better products with knowledge in solid mechanics. You are exposed to a wide variety of engineering concepts and solutions. Several design exercises gives you abilities to solve industrial problems. The FEM is our tool, mainly Ansys Classic but also Workbench. In optimization and reliability some computations are performed with MatLab.

In **FATIGUE**, the emphasis is on computer-based FEM-compatible 3D HCF-models that are applicable to general stress histories. Also models for the probability of failure are presented. In **RELIABILITY**, engineering statistics is covered from the basics to the state-of-the-art: Optimization of structures with many stochastic variables and parameters and with probabilistic constraints. In the **DESIGN** part of the course, we go from the functionality of structures via FEM-technology to optimization (shape, topology, size..) and robustness/quality.

The course is intended for 2nd year master students who have taken many courses in solid mechanics and who are used to computations with the FEM. Starting from that level, the lecture series present theory and applications, anecdotes, ideas, background and practices regarding industrial problem-solving. There are industrial guest lectures. The course is finalized with project presentations.

All lectures, seminars and presentations are in the **Seminar room** at the Department of Solid Mechanics.

Mårten Olsson, examiner

During the course a participant should acquire experience and become able to:

- explain the role of solid mechanics modeling and computation in the product development process, in particular in relation to a multitude of failure modes;
- consider also hidden failure modes in the above mentioned situation;
- identify mechanical requirements on components and structures and translate them into a mechanical model that is suitable for computations;
- select appropriate FE-meshes, elements, boundary conditions, material models, etc, for efficient problem solving;
- describe the purpose and ideas of different design strategies;
- use advanced methods for FE-based fatigue design (LCF, HCF and TMF);
- describe different forms of uncertainty and estimate the scatter of stochastic variables;
- illustrate and explain how uncertainty in a problem spread to uncertainty in the system response;
- select an appropriate method for exploration of the design space;
- perform probabilistic design with FEM based on direct Monte Carlo simulation or with a surrogate model (RSM);
- solve an advanced product development problem and communicate the solution in the form of a poster, an oral presentation and a technical report.

Course contents

The course is based on advanced, higher level, use of solid mechanics theory and modeling. This is added to the already acquired knowledge of the participants. The course is mainly experiential. The course includes a lecture series, including guest lecturers from industry. There are individual design exercises as well as a larger final project to be solved in a small group.

Specific prerequisites

Compulsory courses are SE1010 Strength of materials and solid mechanics basic course, or SE1012 Strength of materials and solid mechanics basic course, or SE1020 Strength of materials and solid mechanics basic course, or SE1055 Strength of materials and solid mechanics basic course, and SE1025 FEM for Engineering Applications. Recommended courses are SE2132 Applied Elasticity with FEM and SE2126 Material Mechanics.

Course literature

Kompendium, särtryck och utdelat material

Examination

- HEM1 - Assignment, 3.0 credits, grading scale: P, F
- PRO1 - Project, 6.0 credits, grading scale: A, B, C, D, E, FX, 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 work (PROJ, 6.0 university credits)
Active participation in seminars (SEM1, 3.0 university 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.