SD2175 Numerical Methods for Acoustics and Vibration 9.0 credits

Numeriska metoder för akustik och vibrationer

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

Establishment

The course syllabus is valid from Spring 2022 according to the school principal's decision: S-2022-0529 Decision date: 2022-02-24

Grading scale

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

Education cycle

Second cycle

Main field of study

Specific prerequisites

Basic courses in mathematics and mechanics.

English B / English 6

Language of instruction

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

Intended learning outcomes

After completing this course, students should be able to:

- Explain the key concepts behind numerical methods for acoustics and vibrations, such as finite element and finite difference methods, and discuss them in terms of simplifications, accuracy, performance and validation.
- Apply numerical theory to acoustics and vibrations problems by implementing it in numerical programs, and perform numerical calculations using computational software such as Matlab and Comsol Multiphysics.
- Reflect on numerical implementations, choose appropriate modelling approaches and troubleshoot problems that arise.
- Evaluate and critically judge numerical results in order to suggest improvements from both physical and numerical modelling perspectives.
- Present the outcome of their work in group discussions, formal oral presentations and written reports.

Course contents

Introduction to numerical methods in engineering. Mathematical models versus numerical models. Finite difference method. Galerkins method and method of weighted residuals. Simple elements. Stiffness method. Element formulations. Coordinate transformations. Isoparametry. Numerical interpolation. Convergence properties for dynamic problems. Hierarchical elements. Direct and iterative solvers. Eigenvalue analysis. Modal superposition. Integral equations. Examples of acoustic radiation and scattering using BEM. Simple fluid-structure interaction. Response analysis of a coupled problem. Modelling of damping and its effect on the response.

Examination

- INLA - 4x Assignment & Written report, 6.0 credits, grading scale: P, F
- PROA - Project & Oral and Written Report, 3.0 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.

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

Other requirements for final grade

Examination, written test (TEN1; 4 university credits), Assignments (INL1; 3 university credits), Computer task, oral defence (INL1, 2 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.