SF1693 Analytical and Numerical Methods for Partial Differential Equations and Transforms 11.0 credits

Analytiska och numeriska metoder för partiella differentialekvationer och transformer

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 SF1693 valid from Autumn 2021.

Grading scale

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

Education cycle

First cycle

Main field of study

Technology

Specific prerequisites

- Completed basic course in multivariable calculus (SF1674 or equivalent)
- Completed basic course in numerical methods (SF1550 or equivalent)

Language of instruction

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

Intended learning outcomes

A general goal is that the course should provide the student with skills to handle methods of mathematical analysis, computation, modeling and programming related to partial differential equations.

After the course the student should be able to:

- Use concepts, theorems and methods to solve problems within analytical and numerical aspects of partial differential equations and transforms, included in the course main content.
- Use analytical and numerical methods to solve partial differential equations, included in the course main content, and show insight about the possibilities and limitations for different methods.
- Program numerical methods for basic partial differential equations.
- Read and write mathematical text and present mathematical results.

Course contents

Equations: Time-independent elliptic partial differential equations, time-dependent parabolic and hyperbolic partial differential equations, with application to diffusion, linear and non-linear waves, eigenvalue problems and optimization.

Areas of application are selected from: heat conduction, diffusion, solid mechanics, fluid mechanics, electromagnetics, quantum mechanics, acoustics and vibrations.

Concepts: wellposedness, Hilbert space, orthogonality, regularity, boundary value and initial value problems, fundamental solution, convergence, condition number, stability, weak and strong solutions, distributions, entropy conditions.

Analytical methods: characteristics, Fourier series, separation of variables, Fourier transform, variational methods, calculus of variation, maximum principles.

Numerical methods: the finite element method, finite difference methods, iterative methods, optimization methods, adaptive methods, fast Fourier transform, interpolation theory, quadrature.

Examination

- LAB1 - Laboratory work, 5.0 credits, grading scale: P, F

- TEN1 - Written exam, 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.

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.