SF1523 Analytical and Numerical Methods for Differential Equations 7.5 credits

Analytiska och numeriska metoder för differentialekvationer

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 SF1523 valid from Autumn 2014

Grading scale

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

Education cycle

First cycle

Main field of study

Technology

Specific prerequisites

This course gives an overview and basic skills in differential equations solving and the related numerical methods for simulating technical and scientific processes based on mathematical models.

Language of instruction

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

Intended learning outcomes

The overall goal of the course is to give the students basic skills in analytical and numerical methods and computer programming to make reliable and effective simulations of technical and scientific processes based on mathematical models.

After the course the student should be able to:

- formulate and use basic numerical methods for differential equations,
- write computer code using e.g. the program Matlab to solve differential equations,
- analyze computational work and accuracy for basic computational problems,
- formulate and solve first order differential equations by separation of variables and integrating factor,
- formulate and solve higher order differential equations by the characteristic equations and particular solution,
- solve linear systems of differential equations by diagonalization,
- conclude stability or instability of some differential equations by linearization and eigenvalue analysis,
- solve some partial differential equations by separation of variables and Fourier series,
- solve some partial differential equations by using the Fourier transform.

Course contents

- Equations: first and higher order scalar differential equations, systems of differential equations of first order, partial differential equations for heat conduction and waves,
- Concepts: discretization, approximation, convergence, condition numbers, linearization, stability,
- Methods: integrating factor, diagonalization, Fourier series, separation of variables, Fourier transform,
- Numerical method for integrals and differential equations: Eulers method, Runge-Kutta methods, the backward Euler method, boundary value problems, finite difference methods for heat conduction and waves,
- Numerical methods for optimization: Newton's method, Lagranges method.

Course literature

The course literature will be announced on the course homepage at least four weeks before the start of the course.

Examination

- LABA - Laboratory Works, 2.5 credits, grading scale: P, F
- TEN1 - Examination, 5.0 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.

In this course, the code of honour of the school is applied,
see: http://www.sci.kth.se/institutioner/math/avd/na/utbildning/hederskodex-for-studenter-och-larare-vid-kurser-pa-avdelningen-for-numerisk-analys-1.357185

Other requirements for final grade

Written exam (TEN1) and hand-in problems (LABA).

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.