SF1544 Numerical Methods, Basic Course IV 6.0 credits

Numeriska metoder, grundkurs IV

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 SF1544 valid from Autumn 2013

Grading scale

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

Education cycle

First cycle

Main field of study

Technology

Specific prerequisites

For non-program students: basic university qualification and 15 credits in mathematics and 6 credits computer science or programming techniques.

Language of instruction

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

Intended learning outcomes

The course gives an overview of numerical methods for simulation of technical and scientific processes based on mathematical models. The general aim is that you should be able to solve simple such problems by means of numerical methods and be able to assess the reliability of the numerical solution. You also should be able to explain a method's advantages and disadvantages by analysing it regarding some important theoretical concepts. The course should furthermore give you an experience to use software suited for calculations and numerical problem-solving, as e.g. Matlab and COMSOL Multiphysics.

You should more specific after the course be able to

1. For a general problem formulation refine and classify the mathematical sub problems that need to be solved.

2. Choose appropriate numerical methods for the mathematical standard problem that are included in the course (see below), and explain how and why the methods work.

3. Apply the methods in an appropriate programming language, e.g. Matlab, and estimate reliability and parameter sensitivity in the numerical solution.

4. Evaluate and analyse the advantages and limitations of numerical methods by

• deciding the order of accuracy/sped of convergence of a method and explaining how this controls the size of the error

• deciding the complexity of a method and explaining how it influences the computational cost

• explaining how the condition of a problem influences the reliability in a numerical solution and deciding the condition for simple problems

• explaining the importance of stability of methods for ordinary differential equations (ODE) and deciding the stability limit for simple methods.

5. Solve partial differential equations (PDE) of standard type using mathematical software, e.g. COMSOL Multiphysics.

Course contents

Numerical methods for various types of linear systems of equations (full, triangular, banded), the least squares method for inconsistent systems, nonlinear equations (scalar and system), eigenvalue problem, integration, derivation, interpolation and initial and boundary value problems for ODE. Basic technologies for numerical methods, as iteration, linearisation, discretisation and extrapolation, and theoretical concepts as order of accuracy, speed of convergence, complexity, condition and stability. Numerical solution to PDE problems by means of mathematical software.

Course literature

Announced no later than 4 weeks before the start of the course on the course web page

Examination

- LABA - Laboration Work, 1.5 credits, grading scale: P, F
- LABB - Laboration Work, 1.5 credits, grading scale: P, F
- TEN1 - Written Examination, 3.0 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.

- LABA - Laboratory sessions, 1.5 credits, grading scale: P, F
- LABB - Laboratory sessions, 1.5 credits, grading scale: P, F
- TEN1 - Examination, 3.0 credits, grading scale: A, B, C, D, E, FX, F

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

A written examination (TEN1; 3 credits).
Laboratory assignments (LABA; 1.5 credits).
Laboratory assignments (LABB; 1.5 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.