FSF3566 Numerical Methods for ODEs and DAEs 7.5 credits

Numeriska metoder för ODEs och DAEs

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

Establishment

Course syllabus for FSF3566 valid from Autumn 2016

Grading scale

G

Education cycle

Third cycle

Specific prerequisites

This course is designed for PhD students in applied and computational mathematics, but it is suitable also for other PhD students with a background in computation with mathematical interests. The students are expected to have taken the basic and a continuation course in numerical analysis or acquired equivalent knowledge in a different way.

Language of instruction

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

Intended learning outcomes

The course will give the students an introduction to the construction principles, theory, and implementation issues of modern methods for ODEs and DAEs.

After completion of the course the students can

- construct advanced numerical methods for ODEs and DAEs;
- investigate consistence and stability for given numerical methods;
- construct stepsize controllers and analyze their control theoretic properties;
- analyze the analytical properties of and DAEs;
- analyze the asymptotic properties of numerical integration schemes.

Course contents

- One-step methods, convergence, stability, stiffness
- Errors, adaptivity
- Runge-Kutta methods, accuracy conditions, stability
- Preservation of invariants, symplectic methods
- Linear multistep methods, errors, stability, implementation issues
- Analytic properties of DAEs
- Numerical methods for DAEs and their properties

Disposition

Lectures

Course literature

G. Dahlquist, Numerical Methods for Ordinary Differential Equations, lecture notes.

P. Deuflhard, F. Bornemann, Scientific Computing with Ordinary Differential Equations, Springer, 2002.

E. Hairer, S. P. Nørsett, G. Wanner, Solving Ordinary Differential Equations, Vol I, Springer, 1993.

E. Hairer, G. Wanner, Solving Ordinary Differential Equations, Vol II, Springer, 1996.

Examination

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.

A proposal for the final examination project will be provided. If the student has a proposal for his/her own project, it can be used after approval by the course leader. Additionally, four homework assigmnets must be submitted

Other requirements for final grade

Four homework assignments and a project completed.

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.