FSF3562 Numerical Methods for Partial Differential Equations 7.5 credits

Numeriska metoder för partiella 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 FSF3562 valid from Spring 2019

Grading scale

G

Education cycle

Third cycle

Specific prerequisites

A Master degree including at least 30 university credits (hp) in in Mathematics (including differential equations and numerical analysis).

Language of instruction

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

Intended learning outcomes

Goal: To understand and use basic methods and theory for numerical solution of partial differential equations, which includes that the student after the course can:

- formulate and prove Lax-Milgrams theorem,
- formulate, analyze and use multigrid methods,
- prove a posteriori and a priori error estimates for elliptic partial differential equations,
- prove interpolation error estimates,
- formulate and use finite element and finite difference methods for partial differential equations,
- formulate and prove Lax equivalence theorem,
- use Lax equivalence theorem to analyze finite difference methods,
- formulate and use adaptive numerical methods for partial differential equations,
- formulate and use symplectic numerical methods for Hamiltonian systems.

Course contents

Some topics: finite difference methods, finite element methods, multi grid methods, adaptive methods.
Some applications:

- elliptic problems (e.g. diffusion)
- parabolic problems (e.g. time-dependent diffusion)
- hyperbolic problems (e.g. convection)
- systems and nonlinear problems (conservation laws).

Disposition

Lectures and seminars

Course literature

- Stig Larsson and Vidar Thomee, Partial Differential Equations with Numerical Methods, Springer-Verlag (2009), ISBN 978-3--540-88705-8, (ST)
- Claes Johnson, Numerical Solution of Partial Differential Equations by the Finite Element Method, Dover Publication (2009), Cambridge University Press (1988) (CJ)
- Adaptive FEM lecture notes (LN1)
- Finite difference methods lecture notes (LN2)

The literature overlaps, so the list gives alternatives.

Examination

- INL1 - Assignment, 7.5 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.

Homework

Computer lab

Written exam

Other requirements for final grade

Home assignments completed

Written exam 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.