Faculty of Science

NUMN13, Numerical Analysis: Adaptive Finite Elementmethods, 7.5 credits

Numerisk analys: Adaptiva Finita Elementmetoder, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2007-04-12 to be valid from 2007-07-01, autumn semester 2007.

General Information

The course is an elective course for second-cycle studies for a Degree of Master of Science (120 credits) in mathematics.

Language of instruction: Swedish and English

Main field of studies	*Depth of study relative to the degree requirements*
Mathematics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Learning outcomes

The aim of the course is that students on completion of the course should have acquired the following knowledge and skills:

Knowledge and understanding

The student should obtain knowledge of the mathematical and numerical difficulties of adaptive finite element methods. One should understand modern a posteriori error estimates based on duality and goal oriented adaptivity, a recent Swedish-German calculation technique.

Skills and abilities

Student should be able to independently apply a goal oriented adaptive Finite Element Method (FEM) to the Poisson equation as well as to eigenvalue problems. The student should be able to estimate the accuracy of the results using local error indicators.

Judgement and approach

The student should during the course

- write a logically well structured report in suitable terminology on the construction of basic mathematical models and algorithms.
- write an algorithmically well structured report in suitable terminology on the adaptive and goal oriented numerical approximation of partial differential equations.

Course content

The course consists of one part of 7.5 credits.
A model problem, Finite Element approximation, error estimates for output functionals, goal oriented mesh adaption, higher order finite elements, practical aspects, Galerkin approximation of non-linear problems. Applications: Eigenvalue problems, time dependent partial differential equations (the heat equation, the wave equation), applications in structural and fluid mechanics.

Course design

The teaching consists of lectures and computer sessions.

Assessment

Examination takes the form of written laboratory reports during the course. For the final assessment, the results of the individual reports are combined.

Subcourses that are part of this course can be found in an appendix at the end of this document.

Grades

Marking scale: Fail, Pass, Pass with distinction.
To pass the entire course, approved laboratory reports are required.
The final grade is determined from the joint grades on the individual laboratory reports.

Entry requirements

For admission to the course, general entry requirements, English B and knowledge equivalent to the course NUMA12 Numerical Approximation, 7.5 credits, are required.

Subcourses in NUMN13, Numerical Analysis: Adaptive Finite Elementmethods

Applies from H07

0701 Adaptive Finite Element Methods, 7,5 hp
Grading scale: Fail, Pass, Pass with distinction