SF2561 The Finite Element Method 7.5 credits

Finita elementmetoden

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 SF2561 valid from Autumn 2020

Grading scale

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

Education cycle

Second cycle

Main field of study

Mathematics,Technology

Language of instruction

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

Intended learning outcomes

An overall goal of the course is to provide the student with both theoretical and practical skills to make reliable and efficient computations using the finite element method for models, described as Partial Differential Equations (PDEs), treated in the course as described in the course content.

After completing the course, the student shall be able to

- given a PDE rewrite it in a form suitable for treatment with the finite element method.
- describe key concepts and basic ideas of the finite element method and be able to use these concepts and ideas to describe advantages and limitations of the finite element methods included in the course.
- describe, apply, and implement the finite element methods included in the course.
- derive error estimates for the finite element solution, stability of the finite element method and well-posedness of the given PDE using theorems and analytical procedures included in the course.

Course contents

For elliptical and parabolic differential equations, and briefly for hyperbolic problems, the course addresses how to rewrite the problem in a form suitable for treatment with the finite element method, select appropriate mesh, element, variational formulation and how to implement the finite element method using both self-written code and existing routines. The theoretical part of the course deals with deriving error estimates and stability results given scalar linear partial differential equations.

The course deals with, for example: the weak formulation, mesh generation, function spaces, different element types, the Lax-Milgram theorem, interpolation, a priori error estimates, a posteriori error estimates, adaptivity, stability, accuracy, computational cost and discretization.

Specific prerequisites

- Completed basic course in numerical analysis (SF1550 or SF1544 or equivalent) and
- Completed basic course in computer science (DD1331 or DD1320 or equivalent)

Examination

- LAB2 - Laboratory Work, 4.5 credits, grading scale: P, F
- TEN2 - 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.

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.