LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Finita elementmetoden
Finite Element Method

FHLF20, 7,5 credits, G2 (First Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED M
Date of Decision: 2023-04-11

General Information

Main field: Technology.
Elective Compulsory for: I3, M3
Elective for: BME4-bdr, E4, MD4, N4
Language of instruction: The course will be given in English

Aim

The aim of the course is to provide a method for the solving of physical problems that are described by partial differential equations. The project in the course aim at giving the student an experience and theoretical understanding in solving comprehensive physical problems using the finite element method.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- understand the derivation of the finite element method for physical problems
- understand how the finite element method is applied to physical problems
- understand the differences between balance laws and constitutive laws
- understand the differences between different boundary conditions and how they are implemented

Competences and skills
For a passing grade the student must

- be able to transform the strong form of a differential equation to the weak form
- be able to establish the finite element formulation from the weak form

- have the knowledge to write a finite element program
- be able to implement boundary conditions

Judgement and approach
For a passing grade the student must

- have the ability to analyse, to model and to simulate physical problems with the finite element method, as well as interpret the results
- have the understanding that different technical and physical problems can be modelled and simulated with the same numerical tools

Contents

- Strong and weak formulation of differential equations.
- Approximating functions.
- Galerkin's method.
- Finite element formulation of heat conduction.
- Finite element formulation of deformable bodies.
- Finite element formulation of bending.
- Isoparametric elements and numerical integration.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Written exam and approved project assignment. The result of the written exam defines the final mark.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts
Code: 0118. **Name:** Project.
Credits: 1,5. **Grading scale:** UG. **Assessment:** The assignment will be marked with failed or passed. The assignment can only be made during the course but if marked with failed the student will be given the possibility to correct the assignment.
Code: 0218. **Name:** Examination.
Credits: 6. **Grading scale:** TH. **Assessment:** The written examination will be marked with TH grading scale (U,3,4,5).

Admission

Admission requirements:

- FMAB20 Linear Algebra
- FMAB30 Calculus in Several Variables or FMAB35 Calculus in Several Variables
- FMAA01 Calculus in One Variable or FMAA05 Calculus in One Variable or FMAB45 Calculus in One Variable A1 or FMAB65 Calculus in One Variable B1
- FMAA01 Calculus in One Variable or FMAA05 Calculus in One Variable or FMAB50 Calculus in One Variable A2 or FMAB70 Calculus in One Variable B2
- FMAA01 Calculus in One Variable or FMAA05 Calculus in One Variable or FMAB60 Calculus in One Variable A3 or FMAB70 Calculus in One Variable B2

Assumed prior knowledge: Solid Mechanics.

The number of participants is limited to: No
The course overlaps following course/s: FHLF01, VSMN25, VSMN30

Reading list

- Ottosen, N.S & Petersson, H.: Introduction to the Finite Element Method. Prentice Hall 1992. ISBN 0-13-473877-2.
- CALFEM - A finite element toolbox to MATLAB. Studentlitteratur.
- Wallin, M., Introduction to the Finite Element Method Exercises.

Contact and other information

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Course homepage: http://www.solid.lth.se