LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Finita elementmetoden och introduktion till materialmekanik
Finite Element Method and Introduction to Strength of Materials

FHLF25, 9 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.
Compulsory for: F3, Pi3
Language of instruction: The course will be given in Swedish

Aim

The course has two main objectives where the first is to provide basic understanding of fundamental concept used within solid mechanics. The second 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 aims 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 concept of stresses, strains and elasticity
- understand the concept of torsion of circular sections
- understand the concept of bending of beams
- understand the concept of yield surface
- understand the derivation of the finite element method for linear problems
- understand how the finite element method is applied to linear problems

- understand the differences between balance laws and constitutive laws
- understand the differences between different boundary conditions and how they are implemented in a finite element program

Competences and skills
For a passing grade the student must

- be able to interpret and calculate strains and stresses for a deformation field
- be able to calculate twist and deflection
- 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
- be able to write a finite element program

Judgement and approach
For a passing grade the student must

- have the ability to analyze, to model and to simulate linear structures with the finite element method, as well as interpret the results
- be able to perform a simple analytical analysis on elastic structures
- have the understanding that different technical and physical problems can be modelled and simulated with the same numerical tools

Contents

- Stresses and strains
- Hooke's law
- Torsion
- Material models
- Yield conditions
- Bending
- Discrete systems.
- Strong and weak formulation of differential equations.
- Approximating functions.
- Weighted residual methods and Galerkin’s method.
- Finite element formulation of heat conduction.
- Finite element formulation of elastic bodies.
- 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 project report shall be written in English.

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: 0122. **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: 0222. **Name:** Written Examination.
Credits: 7,5. **Grading scale:** TH. **Assessment:** The written examination will be marked with TH grading scale (U,3,4,5).

Admission

Assumed prior knowledge: Applied Mathematics (FMAN55) or equivalent courses and basic courses in mechanics
The number of participants is limited to: No
The course overlaps following course/s: FHLF20, FHLF01, VSMN25, VSMN30, FHLA10, FHLF15

Reading list

- Ottosen and Petersson: Introduction to the Finite Element Method. Prentice Hall, 1992. Introduction to the Finite Element Method Ottosen and Petersson Prentice Hall.
- CALFEM - A finite element toolbox to MATLAB. Studentlitteratur.
- Wallin, M., Introduction to the Finite Element Method Exercises.
- Ljung, Ottosen och Ristinmaa: Kompendie som tillhandahålls av Inst.

Contact and other information

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