Finita elementmetoden - konstruktionsberäkningar
The Finite Element Method - Structural Analysis

VSMN30, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED V
Date of Decision: 2023-03-21

General Information

Elective for: V4-at, V4-ko
Language of instruction: The course will be given in English on demand

Aim

The aim of the course is to continue the knowledge gained in the course ""Finite Element Method - Flow analysis" by giving detailed theoretical and practical knowledge to be able to model and analyse general solid mechanics problems described from a physical context. Problems within the field of engineering that will be studied are based on stresses, strains, 2- and 3-dimensional elasticity problems, beams and plates. Furthermore, a brief introduction to non-linear structural mechanics problems is given.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to define linear static structural mechanics problems in 1d-3d and interpret their physical terms.
- from physical relations be able to formulate a mathematical model for the problem.
- be able to transfer a mathematical model, through the weak formulation, to a finite element formulation.
- be able to explain convergence, completeness and compatibility requirements for approximating functions.

- be able to describe the formulation of isoparametric elements and numerical integration.
- be able to define and utilise various types of boundary conditions and loadings.

Competences and skills
For a passing grade the student must

- be able to create finite element models of real solid mechanics problems from a physical described context.
- be able to perform finite element analyses of various types of engineering problems.

Judgement and approach
For a passing grade the student must

- be able to analyse and interpret results from a finite element simulation.
- be able to estimate the reliability of a finite element analysis.

Contents

The course consists of lectures, exercise sessions and compulsory design assignments. The knowledge from the course "Finite Element Method - Flow analysis" is increased by gradually introducing more advanced problems to this basic knowledge, such as, two- and three-dimensional solid mechanics problems. Solid mechanics problems that are studied: stresses and strains, 2 and 3D elasticity, beams and plates. At the end of the course the theory for isoparametric finite elements and numerical integration is introduced. The design assignment illustrate the procedure of transferring a design problem into a model suitable for finite element analysis.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Approved written examination, approved compulsory design assignments and an oral presentation.

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: 0119. **Name:** Written Exam.
Credits: 5. **Grading scale:** TH. **Assessment:** Approved written exam. **Contents:** The entire course content.
Code: 0219. **Name:** Design Assignments.
Credits: 2,5. **Grading scale:** UG. **Assessment:** Approved design assignments.

Admission

Admission requirements:

- VSMN25 The Finite Element Method - Flow Analysis: part Design Assignments 2.5 hp

The number of participants is limited to: No
The course overlaps following course/s: FHL064, VSM040, FHLF20

Reading list

- Ottosen, N., Petersson, H.: Introduction to the Finite Element Method. Pearson Education, 1992, ISBN: 9780134738772.
- Olsson, K.-G and Heyden, S.: Introduction to the Finite Element Method, Problems. Studentlitteratur AB, 2007, ISBN: 9789144051260.
- Austrell, P-E., et. al.: CALFEM - A finite element toolbox Version 3.4. Studentlitteratur AB, 2004, ISBN: 9789188558237.

Contact and other information

Course coordinator: Professor Kent Persson, Kent.persson@construction.lth.se
Course homepage: http://www.byggmek.lth.se