LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Beräkningsbaserad materialmodellering Computational Inelasticity

FHLN05, 7,5 credits, A (Second Cycle)

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

General Information

Elective for: BME5-bdr, F4, F4-bem, M4-bem, M4-tt, Pi4-bem, V5-ko
Language of instruction: The course will be given in English

Aim

The course provides an understanding of the mathematical description of non-linear material behaviour. The student will be provided with the mathematical tools necessary for establishing material models as well as the numerical background necessary for the numerical implementation.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- understand the assumptions and simplifications used in the mathematical description of a material model
- explain and use different non-linear elastic models
- understand the framework defining the theories of plasticity and viscoplasticity
- understand the assumptions done in a numerical implementation of a material model

Competences and skills
For a passing grade the student must

- be able to establish the non-linear finite element formulation as well as the corresponding solution strategies
- write a materially non-linear finite element program
- implement a plasticity/viscoplasticity model

Judgement and approach
For a passing grade the student must

- have the capacity to follow the development taking place regarding material modelling, both with respect to theoretical and numerical issues.

Contents

In the course, non-linear material models are considered, as well as the numerical issues when the models are implemented into a non-linear finite element program.

In the course the following subjects are considered:

- Theory for non-linear elasticity, plasticity theory and different types of fracture criteria
- Finite element formulation of non-linear problems
- Implementation of non-linear material models into a finite element code.

The projects, in which non linear material problems are considered, consist of an analytical part and a numerical part. In the numerical part the material model is implemented. The program is then used for describing the response of a structure.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: The course is given in seminar form and treats modern aspects of constitutive modelling. Two project assignments should be solved in the course. Examination is based on the two project assignments and a final written exam. The projects consider materially non-linear problems, containing both a theoretical and a numerical part, which are used to solve a practical problem. The three parts will then provide a final grade.

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: 0112. **Name:** Computational Inelasticity.
Credits: 7,5. **Grading scale:** TH.
Code: 0212. **Name:** Project.
Credits: 0. **Grading scale:** UG.

Admission

Admission requirements:

- FHLF01 Finite Element Method or FHLF20 Finite Element Method or VSMN30 The Finite Element Method - Structural Analysis

The number of participants is limited to: No

Reading list

- Ottosen, N. S. & Ristinmaa, M: The Mechanics of Constitutive Modelling. Elsevier, 2005. ISBN: 0-008-044606-X.
- CALFEM - A finite element toolbox to MATLAB. Studentlitteratur.

Contact and other information

Course coordinator: Professor Matti Ristinmaa, Matti.Ristinmaa@solid.lth.se
Course homepage: http://www.solid.lth.se