SYLLABUS

# Finite element analysis of solid structures 7.5 credits M7009T

## Finita elementmetoden för mekanisk analys

**Course syllabus admitted: Autumn 2023 Sp 1 - Present**

DECISION DATE
**2022-02-14**

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LULEÅ TEKNISKA UNIVERSITET

# Finite element analysis of solid structures 7.5 credits M7009T

## Finita elementmetoden för mekanisk analys

## Second cycle, M7009T

| Education level | Grade scale | Subject | Subject group (SCB) |
|---|---|---|---|
| Second cycle | G U 3 4 5 | Hållfasthetslära | Mechanical Engineering |

# Entry requirements

Basic course in strengt of materials and solid mechanics, and introductory course in numerical analysis including the finite element method.

# Selection

The selection is based on 30-285 credits

# Course Aim

After passing the course, divided into three categories below, the student should be able to:

*Knowledge and understanding*

- describe the underlying theories on which the finite element method (FEM) is based
- describe how and why non-linear mechanical phenomena affect the choice of solution method
- explain the basic theory behind elasto-plastic constitutive relation
- explain the basic principles for optimization
- explain basic contact formulations

*Skills and Abilities*

- solve mechanical problems with nonlinear properties
- identify different load and boundary conditions
- understand and evaluate different contact types and material parameters
- apply FE analysis of structures and components
- combining CAD and FEM to solve mechanical problems
- present results obtained in both written and oral form

*Valuation and approach*

- evaluate how the finite element method can be used for dimensioning and product development
- relate the role of numerical methods in sustainable development
- reflect and evaluate challenges in finite element analysis
- feel increased experience of engineering assessments as well as identification and formulation of problems

# Contents

The course covers basic theory of the linear and nonlinear finite element method. Basics of solution methods, material modelling, optimization and contact formulation are also included in the course. Theories for nonlinear numerical analysis and validation of results are included. Practical exercises in modeling, simulation and analysis of dynamic problems as well as various non-linear problems in the finite element program LS-DYNA and Matlab. Basic understanding and knowledge of mechanics, physics and mathematics are important tools. Extent of each part is given in%.

Basic FE formulation (20%)

Equation solution to nonlinear static problems (20%)

Nonlinear FEM in solid mechanics (30%)

Computer exercises (30%)

This course provides an important basis from which to study and work in areas where mechanical components and systems are included, such as engineering mechanics, engineering design, product innovation, engineering, product development and so on.

# Realization

Each course occasion´s language and form is stated and appear on the course page on Luleå University of Technology's website.
The teaching consists of lectures, laboratory work, a project task and assignments. The lectures deal with theory and its application in connection with problem solving. In computer labs and project assignments, the application of theories is practiced by solving mechanical problems. The assignments are extensive and connected to the theories discussed in the lectures. Here the student gets the opportunity to practice oral presentation and written presentation.

# Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided. Grades are based on the written reports and oral presentation of the mandatory assignments.

# Unauthorized aids during exams and assessments

If a student, by using unauthorized aids, tries to mislead during an exam or when a study performance is to be assessed, disciplinary measures may be taken. The term “unauthorized aids” refers to aids that the teacher has not previously specified as permissible aids and that may assist in solving the examination task. This means that all aids not specified as permissible are prohibited. The Swedish version has interpretative precedence in the event of a conflict.

# Overlap

The course M7009T is equal to MTM170

# Course offered by

Department of Engineering Sciences and Mathematics

# Modules

| Code | Description | Grade scale | Cr | Status | From period | Title |
|---|---|---|---|---|---|---|
| 0001 | Compulsory assignment | G U 3 4 5 | 7.5 | Mandatory | A07 | |

# Study guidance

Study guidance for the course is to be found in our learning platform Canvas before the course starts. Students applying for single subject courses get more information in the Welcome letter. You will find the learning platform via My LTU.

# Last revised

by Niklas Lehto, Programme Director 2022-02-14

# Syllabus established

The syllabus was established by the Department of Applied Physics and Mechanical Engineering 2007-02-28, and remains valid from autumn 2007.