

# The Finite Element Method, FEM

Programme course

6 credits

Finita elementmetoden, FEM

TMMI37

Valid from: 2017 Spring semester

**Determined by**

Board of Studies for Mechanical  
Engineering and Design

**Date determined**

2017-01-25

## Main field of study

Mechanical Engineering

## Course level

First cycle

## Advancement level

G2X

## Course offered for

- Mechanical Engineering, B Sc in Engineering

## Entry requirements

Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

## Prerequisites

Linear algebra, multi-variable calculus and basic courses in engineering mechanics, solid mechanics, heat conduction, fluid mechanics and engineering materials

## Intended learning outcomes

The course aims at giving the student

- an insight into the use of computational techniques in applied mechanics
- an insight into how technical computations are used in the design process
- a basic theoretical understanding of the completely dominating computational method, namely the Finite Element Method/FEM
- the ability to independently solve not too advanced problems by using a well known commercial FE software

It is to be noted that the focus in the course will be placed more on the applications of the Finite Element Method than on its theoretical details. The application fields that will mainly be discussed in the course are static solid mechanics and stationary heat conduction. The evaluation of results including material-related aspects will be a standing issue in the course. At the end of the course, the student shall be able to

- give an account of how computations are used in the design process
- give an account of the theoretical basis of FEM
- give an account of the inherent structure of an FE program
- give an account of potential sources of error associated with FE analyses
- use a well known FE software to solve not too advanced problems
- give an account of the importance of result evaluation with respect to e.g. material aspects

## Course content

- Introduction into the use of computational techniques in applied mechanics
- Stress analysis of 2-dimensional rod structures/trusses (with the direct stiffness method); applications, basic relations, matrix problem formulation, laboratory work
- Linear elastic stress analysis of 2- and 3-dimensional solid bodies; applications, basic relations, FE formulation, laboratory work
- One- and multi-dimensional heat conduction analysis; applications, basic relations, FE formulation, laboratory work
- Evaluation of results including material-related questions (standing issue in the course) In addition, a given design problem is to be solved by using the knowledge and skills gained in the course.

## Teaching and working methods

Lectures, teaching classes, laboratory work.

## Examination

LAB2	Optional laboratory assignment for higher grades	0 credits	U, 3, 4, 5
LAB1	Laboratory work	6 credits	U, 3, 4, 5

## Grades

Four-grade scale, LiU, U, 3, 4, 5

## Other information

Supplementary courses: Mechanical vibrations and fatigue

## Department

Institutionen för ekonomisk och industriell utveckling

## Director of Studies or equivalent

Peter Schmidt

## Examiner

Kjell Simonsson

## Course website and other links

## Education components

Preliminary scheduled hours: 48 h

Recommended self-study hours: 112 h

## Course literature

Fastställs senare

## Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at [http://stydokument.liu.se/Regelsamling/Innehall/Utbildning\\_pa\\_grund-\\_och\\_avancerad\\_niva](http://stydokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva).