Finite Element Methods in Linear Structural Mechanics

Module-No./Abbreviation	Credits	Workload	Term	Frequency	Duration
CE-P05/ FEM-I	6 CP	180 h	1st Sem.	Winter term	1 Semester
Courses			**Contact hours**	**Self-Study**	**Group Size:**
FEM in Linear Structural Mechanics			4 SWS (60 h)	120 h	No Restrictions

Prerequisites

Basics in Mathematics, Mechanics and Structural Analysis (Bachelor level)

Learning goals / Competences

After successfully completing the module, the students

- have basic knowledge of the Finite Element Method (FEM),
- are able to transfer initial boundary value problems of structural mechanics into discretized calculation models based on FEM and thus to solve simple tasks of structural mechanics independently (e.g. calculation of truss structures, disc-like or volume structures),
- have advanced knowledge to understand the functionality of calculation programs based on FEM and to critically evaluate their results,
- are able to independently implement corresponding user-defined elements in FE programs and perform numerical analyses of beam and shell structures,
- have knowledge to solve simple coupled problems (temperature, structural mechanics).

Content

The course covers the basic knowledge of linear FEM, which is based on the principle of virtual work. In particular, the following topics are taught in the course:

- Isoparametric finite elements for trusses, slices, beams, shells, three-dimensional volume elements for application in statics and dynamics,
- Finite element formulations for coupled (e.g. thermo-mechanical) problems,
- consistent explanation of the fundamentals (basic equations, principle of variation),
- Numerical integration, assembly of the elements to a discretized structure and the solution of the static and dynamic structure equation,
- Discussion of stiffening effects ("locking") and their avoidance.

Teaching methods / Language

Lecture (2h / week), Exercises (2h / week) / English

Mode of assessment

Written examination (180 min, 100%) / Optional seminar papers, partially with presentations, to get bonus points for the exam (60 hours, deadlines will be announced at the beginning of the semester)

Requirement for the award of credit points

Passed final module examination

Module applicability

MSc. Computational Engineering, MSc. Bauingenieurwesen

Weight of the mark for the final score

4 %

Module coordinator and lecturer(s)

Prof. Dr. techn. G. Meschke, Assistants

Further information