Mechanical Modeling of Materials

Mechanical Modeling of Materials

Module number	Credits	Workload	Semester[s]	Duration	Group size
CE-P02/SE-CO-19/MMoM	6 CP	180 h	3. Sem.	1 Semester[s]	no limitation

Courses	Contact hours	Self-study	Frequency
a) Mechanical Modelling of Materials	a) 4 WLH (60 h)	a) 120 h	a) each winter

Module coordinator and lecturer(s)

Prof. Dr.-Ing. Daniel Balzani

a) Prof. Dr.-Ing. Daniel Balzani

Admission requirements

Recommended previous knowledge:

Basic knowledge in Mathematics and Mechanics (Statics, Dynamics and Strength of Materials)

Learning outcome, core skills

The objective of this course is to present advanced issues of mechanics and the continuum-based modelling of materials starting with basic rheological models. The concepts introduced will be applied to numerous classes of materials. Basic constitutive formulations will be discussed numerically.

After successfully completing the module, the students

- should have a deep understanding of the theoretical basis of classical material models,
- should know how to derive constitutive equations from rheological models,
- should be able to implement a material model with a suitable algorithmic treatment in finite element software.

Contents

a)

Several advanced issues of the mechanical behaviour of materials are addressed in this course. More precisely, the following topics will be covered:

- Basic concepts of continuum mechanics (introduction)
- Introduction to the rheology of materials
- Theoretical concepts of constitutive modelling
- Derivation of 1- and 3-dimensional models in the geometrically linearized setting for
  - Linear- and nonlinear elasticity
  - Damage
  - Visco-elasticity
  - Elasto-plasticity
- Aspects of parameter identification/adjustment
- Algorithmic implementation in the context of the finite element method and analysis of simple boundary and initial value problems

Educational form / Language

a) Tutorial (2 WLH) / Lecture (2 WLH) / English

Examination methods • Written exam 'Mechanical Modeling of Materials' (90 min., Part of modul grade 100 %)
Requirements for the award of credit points
Module applicability • M.Sc. Computational Engineering • M.Sc. Subsurface Engineering
Weight of the mark for the final score Percentage of total grade [%] = 6 * 100 * FAK / DIV FAK: The weighting factors can be taken from the table of contents. DIV: The values can be taken from the table of contents.
Further Information