Mechanical Modeling of Materials

Module-No./Abbreviation	Credits	Workload	Term	Frequency	Duration
CE-P02/ MMoM	6 CP	180 h	1st Sem.	Winter term	1 Semester
Courses			**Contact hours**	**Self-Study**	**Group Size:**
Mechanical Modeling of Materials			4 SWS (60 h)	120 h	No Restrictions

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

Learning goals / competences:
The objective of this class is to present advanced issues of mechanics and the continuum-based modeling 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.

Content
Several advanced aspects regarding the modeling of the mechanical behavior 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 modeling
- 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

Teaching methods / Language
Lecture (2h / week), Exercises (2h / week) / English

Mode of assessment
Written examination (90 min, 100%)

Requirement for the award of credit points
Passed final module examination

Module applicability
MSc. Computational Engineering

Weight of the mark for the final score
4 %

Module coordinator and lecturer(s)
Prof. Dr.-Ing. D. Balzani, Assistants

Further information