Mechanical Modeling of Materials

<table>
<thead>
<tr>
<th>Module-No./Abbreviation</th>
<th>Credits</th>
<th>Workload</th>
<th>Term</th>
<th>Frequency</th>
<th>Duration</th>
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<tbody>
<tr>
<td>CE-P02/ MMoM</td>
<td>6 CP</td>
<td>180 h</td>
<td>1st Sem.</td>
<td>Winter term</td>
<td>1 Semester</td>
</tr>
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<tr>
<th>Courses</th>
<th>Contact hours</th>
<th>Self-Study</th>
<th>Group Size:</th>
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<tbody>
<tr>
<td>Mechanical Modeling of Materials</td>
<td>4 SWS (60 h)</td>
<td>120 h</td>
<td>No Restrictions</td>
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**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**
Master's program Computational Engineering - Module Handbook
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