Computational Plasticity

Module-No./Abbreviation	Credits	Workload	Term	Frequency	Duration
CE-WP12/CoPla	6 CP	180 h	2nd Sem.	Summer term	1 Semester

Courses	Contact hours	Self-Study	Group Size:
Computational Plasticity	4 SWS (60 h)	120 h	No Restrictions

Prerequisites

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Learning goals / Competences

After successfully completing the module, the students

- remember the definitions of the classifications of mechanical behavior and to which materials the different types of behavior can be associated,
- understand the phenomenology and mechanisms of elastic and plastic behavior of crystalline materials,
- know the different types of plasticity models in solid mechanics,
- understand the basic concepts and the mathematical formulation of continuum plasticity and crystal plasticity,
- understand the basic concepts of the numerical implementation of plasticity models,
- can assess which method is most suited to solve a given mechanical problem,
- are able to implement and apply a numerical scheme for the solution of elasto-plastic problems within the finite element method,
- have basic knowledge about the use of homogenization methods to describe plasticity in polycrystals.

Content

- Basics of continuum mechanics and FEM
- Phenomenology and atomistic origin of elastic and plastic deformation
- Concepts of continuum plasticity (yield criterion, flow rule, isotropic and kinematic hardening)
- Rate dependent and rate-independent formulations of continuum plasticity
- Numerical solution schemes for elasto-plasticity (operator split, return mapping, consistent tangent modulus)
- Computational aspects of small and large strain formulations
- Concepts of crystal plasticity (dislocation slip, flow rule, hardening models, consistent tangent modulus)
- Plasticity of polycrystals (Sachs, Taylor and self-consistent model)
- Numerical solution schemes of the crystal plasticity method
- Structure, implementation and application of an Abaqus UMAT

Teaching methods

Lecture (2h / week), Exercises (2h / week) / Homework (60h) / English

Mode of assessment

Written examination (120 min, 100 %) / Bonus points for homework

Requirement for the award of credit points

Passed homework and passed final module examination

Module applicability

MSc. Computational Engineering, MSc. Maschinenbau, MSc. Materials Science and Simulation

Weight of the mark for the final score 6 %
Module coordinator and lecturer(s) Prof. Dr. rer. nat. A. Hartmaier, Assistants
Further information