Karlsruhe Institute of Technology

Seminar im Rahmen des GRK 2078

Referent: **Kaan Inal, Ph.D., Associate Professor**
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Uhrzeit: 14:30 Uhr

Ort: Geb. 10.23, 3. OG, Raum 308.1 (KM-Seminarraum)

Titel: **Multiscale modeling of instabilities and localized deformation in polycrystalline solids**

Abstract

Recent developments in experimental methods, theory, supercomputers and artificial intelligence have enabled very realistic numerical models based on both macro and micro level material models. In this presentation, advanced material constitutive models (micromechanics based) for FCC (aluminum), BCC (Advanced High Strength Steels) and HCP (magnesium) metals are presented. The new models provide accurate predictions of the initiation and propagation of localized deformation and are used actively in materials design. This research concentrates on advanced crystal plasticity theories that accurately capture the microscale deformation mechanisms. The new crystal plasticity based models that can accurately account for various phenomena such as crystallographic slip, deformation twinning, dislocation cells, transformation induced plasticity and backstress are presented. The models have been incorporated into two different homogenization schemes, the well-known Taylor-type and the so-called Crystal Plasticity Finite Element Method (CPFEM). Furthermore, their implementation into new numerical methods such as the so-called Element Free Galerkin Method and the application of machine learning in micromechanics are discussed. Simulations of deformation under complex strain paths (related to metal forming operations) are performed with the new models and various phenomena such as local strain partitioning between deformation mechanisms (slip/twin/transformation), surface roughness, shear banding, etc. are investigated. For certain applications the predictions are compared to experimental data. The new models provide predictions that are in better agreement with experimental observations compared to the other models commonly employed in the literature.

Alle Interessenten sind herzlich eingeladen.

Prof. Dr.-Ing. Thomas Böhlke