FRIEDRICH-ALEXANDER-UNIVERSITÄT ERLANGEN-NÜRNBERG
DEPARTMENT WERKSTOFFWISSENSCHAFTEN
Lehrstuhl I – Allgemeine Werkstoffeigenschaften –
Prof. Dr. M. Göken
Tel.: ++49/9131/85-27501
Fax.: ++49/9131/85-27504

Sonderseminare

(Zwei Vorträge)

Di. 20.12.16, 13:00, ZISC Seminarraum, R 0.02-142, Martensstr. 5a

DAMASK - the Düsseldorf Advanced Material Simulation Kit

Martin Diehl
Max-Planck-Institut für Eisenforschung, Düsseldorf

Crystal plasticity modeling methods have evolved into one of the cornerstones of computational materials science. They combine the tensorial nature of the individual crystallographic shear modes such as carried by dislocations, martensitic transformations, shear bands or mechanical twins with the orientation dependence and polyphase structure of crystalline matter.

With the Düsseldorf Advanced Material Simulation Kit (DAMASK) we try to provide a modular and extensible framework for crystal plasticity simulations at various length scales. At the core of DAMASK is a flexible and hierarchically structured model of material point behavior for the solution of elastoplastic boundary value problems along with damage and thermal physics.

Its main purpose is the simulation of crystal plasticity within a finite-strain continuum mechanical framework. The material point model of DAMASK can be used in combination with commercial FEM solvers like MSC.Marc and Abaqus or with an included spectral solver using fast Fourier transforms.

This talks outlines some details of the implementation of DAMASK such as the staggered integration scheme for the material state and the stress response and the coupling to commercial FEM solvers. Additionally, several examples how DAMASK is used to understand the mechanical behavior of polycrystalline materials are given. As an outline, the integration of further physical effects like temperature evolution, damage, and phase transformation is sketched.

RIEDRICH-ALEXANDER-UNIVERSITÄT ERLANGEN-NÜRNBERG
DEPARTMENT WERKSTOFFWISSENSCHAFTEN
Lehrstuhl I – Allgemeine Werkstoffeigenschaften –
Prof. Dr. M. Göken

Tel.: ++49/9131/85-27501
Fax.: ++49/9131/85-27504

Coupling Phase-field and crystal plasticity simulations

P. Shanthraj, M. Diehl, F. Roters
Max-Planck-Institut für Eisenforschung, Düsseldorf

While crystal plasticity has become a powerful modeling tool for a wide range of mechanical applications, most crystal plasticity models are limited in their treatment of deformation mechanisms such as phase transformations and twinning. In this contribution, we present a finite-strain continuum-mechanical framework to consistently couple crystal plasticity with additional deformation sources. The approach is based on modifying the standard multiplicative decomposition by the introduction of an eigenstrained intermediate configuration. The deformation sources are driven by, for e.g., phase-field equations to model the transformation between arbitrary plastically deforming phases, transport equations to model the diffusion of solutes, as well as thermal conduction and the associated thermal strains. We show the application of such a coupled approach to investigate various kinds of (possibly environmentally assisted) damage phenomenon in plastically deforming poly-crystals.