Institute of Thermomechanics Seminar

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Lecture
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Czech Society for Mechanics
and Institute of Thermomechanics, CAS

invite you to a lecture and discussion within
the lecture series **Institute of Thermomechanics Seminar**

Deformation-Induced Anisotropy in Porous Metals: Constitutive modeling and computational issues

given by

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A constitutive model for a porous metal subjected to general three-dimensional finite deformations is presented. The model takes into account the evolution of porosity and the development of anisotropy due to changes in the shape and the orientation of the voids during deformation. The pores are initially ellipsoidal and distributed randomly in an elastic-plastic matrix (metal). Under finite plastic deformation, the voids are assumed to remain ellipsoids, and to change their volume, shape, and orientation. At every point in the homogenized continuum, a "representative" ellipsoid is considered with principal axes defined by the unit vectors $\mathbf{n}^{(1)}$, $\mathbf{n}^{(2)}$, $\mathbf{n}^{(3)} = \mathbf{n}^{(1)} \times \mathbf{n}^{(2)}$ and corresponding principal lengths a, b and c. The homogenized continuum is locally orthotropic, with the local axes of orthotropy coinciding with the principal axes of the representative ellipsoid. The basic "internal variables" characterizing the state of the microstructure at every point in the homogenized continuum are given by the local equivalent plastic strain $\bar{\varepsilon}^p$, the local void volume fraction or porosity f, the two aspect ratios of the local representative ellipsoid ($w_1 = c/a$ and $w_2 = c/b$) and the orientation of the principal axes of the ellipsoid ($\mathbf{n}^{(1)}$, $\mathbf{n}^{(2)}$, $\mathbf{n}^{(3)}$). A methodology for the numerical integration of the elastoplastic constitutive model is developed. The problem of ductile fracture near the tip of a blunt crack is studied by using the finite element method and comparisons with traditional constitutive models that assume isotropic behavior are made. A "plastic strain-gradient" version of the model will be also presented and issues associated with its numerical implementation will be discussed.

The lecture will be held on Tuesday, November 14, 2017 at 10:00 in the building of the Institute of Thermodynamics (lecture room B), Dolejškova 5, 182 00 Prague 8

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