Seminar

30. September 2010 15:30h HS 44-380

TECHNISCHE UNIVERSITÄT KAISERSLAUTERN

zu folgendem Vortrag wird herzlich eingeladen:

On the modeling and numerical implementation of ferro-electric polymers at large strains

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In recent years, an increasing interest has been shown in functional materials such as ferroelectric polymers. For such materials, viscous effects and electric polarizations cause hysteresis phenomena accompanied with possibly large remanent strains and rotations. Ferroelectric polymers have many attractive characteristics. They are light, inexpensive, fracture tolerant, and pliable. Furthermore, they can be manufactured into almost any conceivable shape and their properties can be tailored to suit a broad range of requirements. In this work, continuous and discrete variational formulations are exploited for the treatment of the non-linear dissipative response of ferroelectric polymers under electrical loading. The point of departure is a general internal variable formulation that determines the hysteretic response of this class of materials in terms of an energy storage and a rate-dependent dissipation function. The ferroelectric constitutive assumptions, which account for specific problems arising in the geometric nonlinear setting, are discussed. With regard to the choice of the internal variables, a critical factor is the kinematic assumptions. Here, we propose the multiplicative decomposition of the local deformation gradient into reversible and remanent parts, where the latter is characterized by a metric tensor. The state of the material is characterized in terms of intermediate configuration variables. Such a formulation allows to reproduce the dielectric and butterfly hystereses of the ferroelectric materials and their rate-dependency. The proposed formulation is suitable for the modeling of non-uniform polarizations in devices that undergo large deformations and rotations. Its performance is demonstrated by means of a spectrum of benchmark problems.

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