Seminar

02. Februar 2011 15:30h HS 42-258

TECHNISCHE UNIVERSITÄT KAISERSLAUTERN

zu folgendem Vortrag wird herzlich eingeladen:

Nonlinear FE-Simulation of piezoceramics under consideration of the electric conductivity

H. Schwaab[1,2], M. Kamlah[1], P. Supancic [2,3]

[1]Institute for Applied Materials, Karlsruhe Institute of Technology (KIT)
[2]Materials Center Leoben Forschung GmbH
[3]Institut für Struktur- und Funktionskeramik, Montanuniversität Leoben

Piezoelectric ceramics belong to the rare class of so called smart or active materials. They can dramatically alter their material properties. By applying a high electric field it is possible to obtain a macroscopic piezoelectric material which couples mechanical strains and electrical fields. Thus they are a prime candidate for sensors and actuator applications.
During this necessary initial poling process high electric fields are applied and this leads to high strains which can initiate cracks. To assess the reliability of piezoceramics components and avoid cracks, a detailed knowledge of mechanical stress and other field quantities like electric field and polarization is necessary. Theoretical simulations are often the only way to obtain these quantities.
Simulations point out that often electric fields remain in the component after poling and that they have an influence on the further behavior of these components. Usually piezoceramic materials are modeled as dielectrics, i.e. as perfect insulators. In fact they are semiconductors with a high but finite ohmic resistance. This will lead to charge-transport phenomena that affect other field quantities.
It is essential to study the significance of this effect. For this purpose the constitutive equations have to be extended as well as the balance laws. In this talk a method to consider the electric conductivity in the FE-Framework is presented. For a simple example analytical solutions can be obtained and compared with the FE-Simulations results.
One example for a component where a non-vanishing electric field appears after poling is a radial poled hollow cylinder. For this geometry the effect of electric conductivity will be discussed.

Prof. Dr.–Ing. habil. Sven Klinkel
Fachgebiet
Statik und Dynamik der Tragwerke
TU Kaiserslautern

Dr.–Ing. Sigrid Leyendecker
Emmy Noether Group
Computational Dynamics and Control
TU Kaiserslautern

Prof. Dr.–Ing. habil. Ralf Müller
Lehrstuhl für Technische Mechanik
TU Kaiserslautern