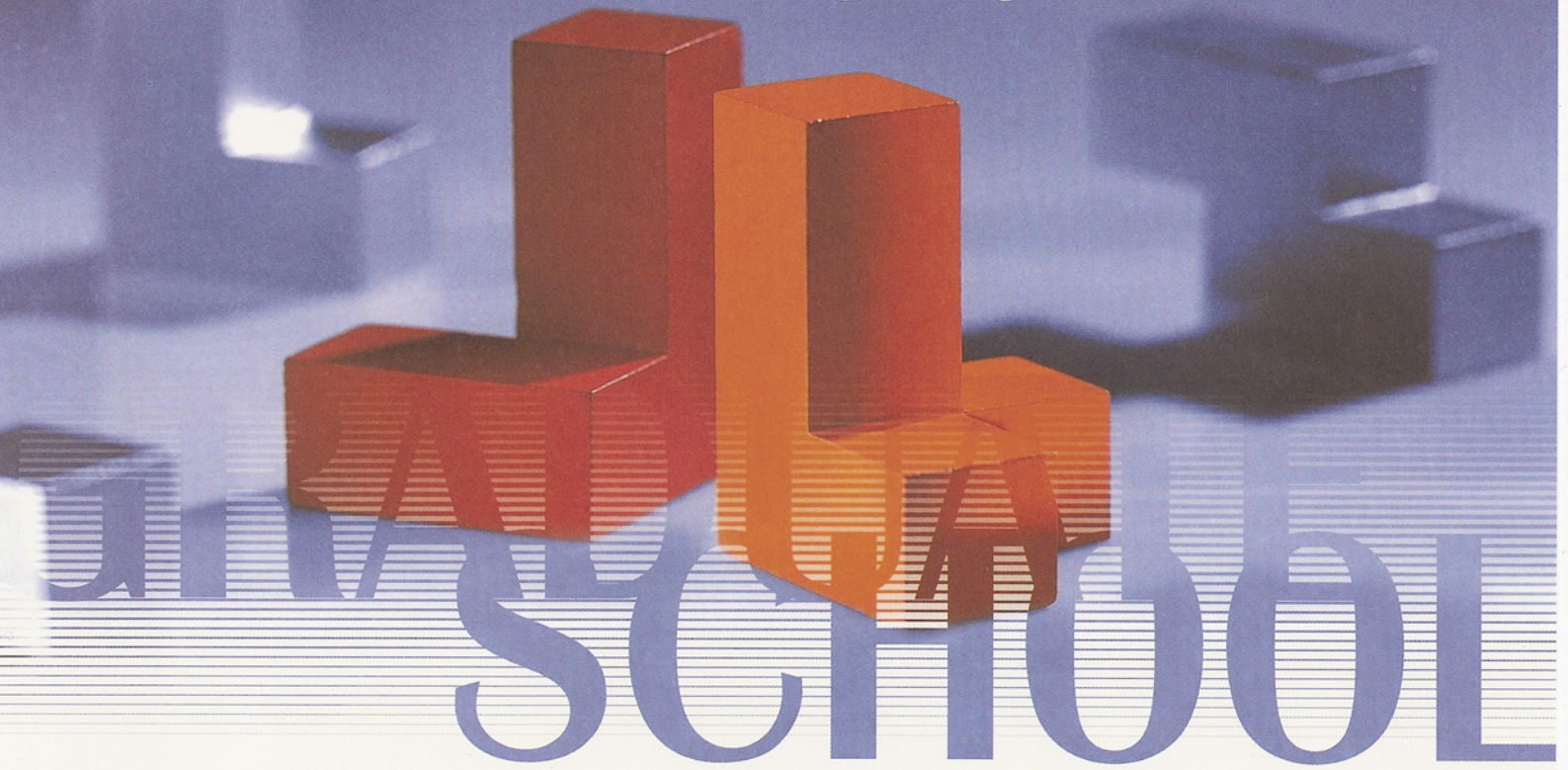
UNIVERSITÄT DORTMUND

Graduate School
of Production Engineering and Logistics



SCHOOL

Prof. Dietmar Gross
TU Darmstadt, Germany

Micromechanics of Piezoelectric Materials

- Date : January 10 th, 2007
- Time : 16:00 – 18:00
- Place : MB Hörsaal 1, Leonard Euler Straße 5

- Abstract :

Ferroelectric materials are widely used in sensor and actuator applications. Their applicability in cyclic loading however is limited by the so-called electric fatigue effect. Under this terminology various macro and micro-mechanical phenomena are summarized. On the macroscopic level a reduction of the mechanical output for a fixed electric excitation is observed. On the microscopic level the blocking of domain walls by point defects or their agglomerates is one of the suspected mechanisms. Since experiments on this level are difficult or nearly impossible numerical simulations are intended to provide a qualitative understanding of the interaction of point defects among themselves, with domain walls and boundaries. In order to model this scenario, the driving forces acting on the defects are identified. This is done within the concept of configurational forces. Once the coupled field equations are solved, possible motions of the defects are computed by applying simple kinetic laws. Different formulations and numerical techniques are applied for this purpose, among them Phase Field Simulations, Finite Elements, Finite Differences and Radon transforms. A number of typical simulations are discussed. They demonstrate the effect of the point defect position and concentration on the driving force acting on the domain wall. The results indicate that the point defects may form in fact barriers which, if high enough, may lead to a blocking of the domain wall. They also show the domain evolution under different boundary and initial conditions.