MS1L_11731

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

A Novel Approach to the Application of Ferroelectric Thin Films to Micro-actuation

Kaushik Bhattacharya

California Institute of Technology, Pasadena, USA

A micro-actuator capable of significant force and displacement remains an outstanding challenge in the development of micromachines. Active materials are attractive for their large work per unit volume, and specifically ferroelectrics since they are electrically activated. However, conventional piezoelectric materials display limited strains (0.1%), and conventional configurations like bi-morph cantilevers are too constrained to deliver the necessary performance. This talk will describe an alternative strategy that combines a new mode of electrostriction in ferroelectrics that explicitly use domain switching to deliver extremely large strains (1–6%) at moderate forces and electrical fields along with a new approach to microactuators that use partially released thin films. Together this strategy enables micro-actuators with large force and displacement. This talk will describe the theoretical analysis of the domain patterns in bulk and thin film ferroelectric perovskites that led to this strategy, detailed computational studies for specific designs and the subsequent experimental validation.

View the extended summary