Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Modeling of dielectric elastomeric materials: theory, finite element simulation, and applications DAVID HENANN, KATIA BERTOLDI, School of Engineering and Applied Science, Harvard University — Elastomeric materials that undergo large deformations in response to an electric field have garnered attention in recent years. Applications of these dielectric elastomeric materials include actuators capable of converting electrical energy to mechanical work and energy harvesting devices that convert mechanical energy into electrical energy. Furthermore, dielectric elastomers exhibit interesting instabilities, especially under constrained geometries, opening the door for possible applications in active surfaces. Interest has increased in the mechanics community concerning the formulation of a finite-deformation constitutive theory for an electro-mechanically-coupled material. While the details of the formulation of such a theory are beginning to come into focus in the literature, numerical techniques for solving these equations are in their infancy. In this work, we have developed a finite-element-based numerical simulation capability for dielectric elastomers. This talk will highlight the application of our numerical simulation capability to dielectric elastomeric actuators, energy harvesting devices, as well instabilities of small dielectric elastomeric structures on a constraining substrate.

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Date submitted: 11 Nov 2011 Electronic form version 1.4