Computational Modeling of Electromechanical Instabilities in Dielectric Elastomers

Harold S. Park
Associate Professor of Mechanical Engineering, Boston University

Abstract: Dielectric elastomers are a class of soft, active materials that have recently gained significant interest due to the fact that they can be electrostatically actuated into undergoing extremely large deformations. An ongoing challenge has been the development of robust and accurate computational models for elastomers, particularly those that can capture electromechanical instabilities that limit the performance of elastomers such as creasing, wrinkling, and snap-through.

I discuss in this work a recently developed finite element model for elastomers that is dynamic, nonlinear, and fully electromechanically coupled. The model also significantly alleviates volumetric locking due that arises due to the incompressible nature of the elastomers, and incorporates viscoelasticity within a finite deformation framework. Numerical examples are shown that demonstrate the performance of the proposed method.

Time permitting, I will also discuss recent work on using novel time scale bridging techniques to study plastic deformations in amorphous solids such as bulk metallic glasses.

Biographical Sketch: Harold S. Park is currently associate professor of Mechanical Engineering at Boston University. Since receiving his Ph.D. in Mechanical Engineering from Northwestern University in 2004, his research has focused on developing and utilizing both atomistic and multiscale modeling approaches to understand surface effects on the behavior and properties of crystalline nanostructures. He is the recipient of a 2007 NSF CAREER award, a 2008 DARPA Young Faculty Award, and the 2009 Gallagher Young Investigator Award from the US Association for Computational Mechanics.

For additional information, please contact Prof. Zhuyin Ren at (860) 486-8994, zhuyin.ren@engr.uconn.edu or Laurie Hockla at (860) 486-2189, hockla@engr.uconn.edu