

MECHANICAL AND AEROSPACE ENGINEERING COLLOQUIUM SERIES

“Modeling Magneto-Mechanical Interactions in Deformable Solids”

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Friday, November 13, 2009

1:30PM

205 Thurston Hall

Refreshments: 2:30pm, 206 Thurston Hall

ABSTRACT

The lecture begins with an overview of experimental results that characterize the elastic behavior of highly deformable solids. This is followed by illustrations of how the behavior departs from the purely elastic; we examine stress softening associated with the Mullins effect, and the different degrees of softening for different materials are highlighted. The main part of the seminar focuses on recent theoretical work concerning the interactions of mechanical and magnetic effects in so-called magneto-sensitive solids. These are being used as active components in various applications where the mechanical stiffness of the material changes rapidly by the application of a suitable magnetic field. Magneto-sensitive solids typically consist of an elastomeric matrix and a distribution of ferromagnetic particles. We summarize the relevant equations and propose a coupled free-energy formulation, which depends on the deformation gradient and on the magnetic induction. Finally, we discuss how constitutive equations are specialized to isotropic incompressible magneto-sensitive elastomers in either Lagrangian or Eulerian form.