

MAE Seminar

Mechanics of Soft Active Materials (SAMs)

Professor Zhigang Suo

School of Engineering and Applied Sciences

Harvard University

Abstract

Soft materials can be made active in that they can greatly change shape and volume in response to diverse stimuli. For example, an elastomer may strain more than 100% under an electric field. As another example, a gel may imbibe a large quantity of small molecules from environment and swell thousand times its initial volume. The amount of swelling may be changed abruptly by small changes in the environment. These soft active materials (SAMs) have enormous potential for applications in drug delivery, tissue engineering, and actuators. My group has recently started a project to formulate field theories for SAMs subject to mechanical, electrical, and chemical loads. The theories address commonly asked questions. How do stress, electric field, and chemical potential interact? What is the interplay of large deformation, polarization, and mass transport? Why do abrupt changes, or instabilities occur? In this talk I'll outline the basic theories and several specific phenomena, including electromechanical instability of dielectric elastomer actuators, and bifurcation in a hydrogel-actuated nanostructure.

Biosketch

Zhigang Suo is the Allen E. and Marilyn M. Puckett Professor of Mechanics and Materials at Harvard University. He earned a Bachelor's degree from Xi'an Jiaotong University in 1985, majoring in Engineering Mechanics. Upon earning a Ph.D. degree in Engineering Science from Harvard University, in 1989, Dr. Suo joined the faculty of the University of California at Santa Barbara and established a group studying the mechanics of materials and structures. The group moved to Princeton University in 1997, and to Harvard University in 2003. Dr. Suo teaches courses in solid mechanics and applied mathematics. His research centers on the mechanical behavior of materials and structures. Basic processes include deformation, fracture, and mass transport, driven by various thermodynamic forces (e.g., stress, electric field, electron wind, chemical potential). Applications are concerned with microelectronics, large-area electronics, and active materials and structures. Dr. Suo has co-authored over 200 archival papers.

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Refreshments will be provided