Electrical & Computer ENGINEERING

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DSN-I Seminar Series

Professor Carmel Majidi

Soft Multifunctional Materials for Soft Robotics

WHEN: October 3, 2014
WHERE: Scaife Hall 125
TIME: 3:30 p.m. - 5:00 p.m.

Abstract

In contrast to conventional machines and electronics, which are typically made out of rigid materials, “soft-matter” technologies are composed almost entirely of soft polymers, gels, and fluids. These include soft-microfluidic electronics, pnuematic actuators, and rigidity-tunable composites that can be designed to exhibit the same intrinsic elasticity and rheology of soft biological matter. Such technologies have the potential to improve biomechanical compatibility and safety in medical robotics, wearable computing, and other applications that depend on human-machine interaction. In this talk, I will present recent efforts by my research group, the Soft Machines Lab, to advance the nascent field of soft-matter engineering with new designs, theories, and fabrication methods. My talk will primarily focus on (a) soft microfluidic electronics with liquid-phase Gallium-Indium alloys and (b) soft lithography for low cost manufacturing. I will emphasize the central role of solid mechanics in design and show how classical solutions can be used to predict soft-matter functionality. This includes the influence of elastic deformations and surface traction (pressure and friction) on the electrical resistance and capacitance of GaIn circuits.

Speaker Bio

Carmel Majidi is an Assistant Professor of Mechanical Engineering at Carnegie Mellon University, where he leads the Soft Machines Lab. Prior to arriving at CMU, Prof. Majidi was a postdoctoral fellow in the School of Engineering and Applied Sciences at Harvard University (December 2009 – August 2011) where he worked with Profs. Robert Wood and George Whitesides to explore new paradigms in soft robotics and soft-matter electronics. From December 2007 to November 2009, he was a postdoctoral fellow in the Princeton Institute for the Science and Technology of Materials (PRISM) and worked with Profs. David Srolovitz (currently at UPenn) and Mikko Haataja (Mechanical & Aerospace Engineering) to examine the physics and morphological stability of piezoelectric nanostructures. Prof. Majidi received his doctoral training at UC Berkeley, where he worked with Profs. Ronald Fearing and Bob Full to examine natural gecko adhesion and develop a gecko-inspired shear-activated adhesive. Prof. Majidi is a recent recipient of Young Investigator awards from DARPA, ONR, AFOSR, and NASA all for work related to soft-matter robotics and engineering.

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