MECHANICAL ENGINEERING

UNIVERSITY of MICHIGAN ■ COLLEGE of ENGINEERING

# Mechanical Engineering Department Seminar Series

# Soft Wearable Robots to Assist Manipulation and Mobility


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**Tuesday, October 13, 2015**

**4:00 – 5:00 pm**

**Room 1200EECS**


**Abstract:**

Next generation wearable robots will use soft materials such as textiles and elastomers to provide a more conformal, unobtrusive and compliant means to interface to the human body. These robots will augment the capabilities of healthy individuals (e.g. improved walking efficiency, increased grip strength) in addition to assisting patients who suffer from physical or neurological disorders. This talk will focus on two different projects that demonstrate the design and fabrication principles required to realize these systems. The first is a soft exosuit that that can apply assistive joint torques to synergistically propel the wearer forward and provide support to minimize loading on the musculoskeletal system. Advantages of the suit over traditional exoskeletons are that the wearer's joints are unconstrained by external rigid structures, and the worn part of the suit is extremely light, which minimizes the suit's unintentional interference with the body's natural biomechanics. The second part of the talk will focus on the development of a soft robotic glove for hand rehabilitation that consists of a wearable textile with attached elastomeric fluid-powered actuators specially designed to match the natural movements of the fingers and thumb. A component of the research is to develop the knowledge and techniques required to design soft multi-material fluid-powered actuators. These actuators are of particular interest to the robotics community because they are lightweight, inexpensive, easily fabricated with emerging digital fabrication techniques and capable of producing complex three-dimensional outputs with simple control inputs. This is accomplished via a multi-step molding process where some combination of fillers (e.g. cloth, paper, particles and fibers) is integrated into a soft elastomeric matrix to create anisotropy in the bulk material properties. Upon pressurization, embedded channels or chambers in the soft actuator then expand in directions with the lowest stiffness and give rise to linear, bending, and twisting motions


**Bio:**

Conor Walsh is the founder of the Harvard Biodesign Lab, which brings together researchers from the engineering, industrial design, apparel, clinical and business communities to develop new technologies and translate them to industrial partners. His research includes new approaches to the design, manufacture and control of wearable robotic devices and characterizing their performance through biomechanical and physiological studies so as to further the scientific understanding of how humans interact with such machines. A key aspect of his lab's work is developing is using soft materials (e.g. textiles and elastomers) to interface to the human body, representing a departure to how wearable robots have been designed for the last half a century. Application areas include, enhancing the mobility of healthy individuals, restoring the mobility of patients with gait deficits and assisting those with upper extremity weakness to perform activities of daily living. Conor is Assistant Professor of Mechanical and Biomedical Engineering at the John A. Paulson Harvard School of Engineering and Applied Sciences and a Core Faculty Member at the Wyss Institute for Biologically Inspired Engineering at Harvard University. Conor received his B.A.I and B.A. degrees in Mechanical and Manufacturing engineering from Trinity College in Dublin, Ireland, in 2003, and M.S. and Ph.D. degrees in Mechanical Engineering from the Massachusetts Institute of Technology in 2006 and 2010.