

Soft robotic actuators: From mechanical design to biomedical applications

Prof. Debkalpa Goswami

Cleveland Clinic Lerner College of Medicine

Case Western Reserve University

Faculty host: Soumik Sarkar

Seminar on April 9, 2024 at 11:00 AM in 2004 Black Engr.

Abstract

Soft robotics is an emerging sub-specialty of robotics that uses soft and/or compliant materials, instead of rigid links, for the design, control, and fabrication of actuators and robots. In contrast to rigid-bodied robots built from metals, ceramics and hard plastics, the compliance of soft robots makes them inherently safe when working in close contact with humans. The growing field of soft robotics provides an ideal opportunity for the development of implantable devices and biomimetic simulation testbeds due to the constituent materials of these actuators possessing mechanical properties comparable to that of biological tissue. Soft robotic devices are pushing the boundaries of robotics in accomplishing tasks that are out of the reach of traditional rigid body systems.

In this talk, I will first present some fundamental mechanical principles we use in the design and manufacturing of modern soft actuators. Next, I will discuss some of our team's recent work leveraging soft robotic technology to build both benchtop and animal models of cardiovascular disease. Finally, I will share ongoing work on novel implantable soft actuators with potential applications in drug delivery and the treatment of diabetes. We will explore how these platforms can be harnessed to simulate disease progression, enabling more accurate and personalized treatment strategies.

Debkalpa Goswami is an Assistant Professor at the Cleveland Clinic Lerner College of Medicine of Case Western Reserve University. He also serves as the Director of Biomechanics of the Cleveland Clinic's Cardiovascular Innovation Research Center, and holds appointments in the Department of Cardiovascular Medicine and the Heart, Vascular, and Thoracic Institute. Debkalpa received his undergraduate degree from Jadavpur University (India) and Ph.D. from Purdue University (West Lafayette, IN). He then completed postdoctoral training in Medical Engineering at the Massachusetts Institute of Technology (Cambridge, MA). He has held full-time research positions at ETH Zurich, Switzerland, and the University of Bremen, Germany, before starting as a faculty at Case Western and Cleveland Clinic. His research group combines soft robotics, 3D printing, biosensing tools, and computational modeling to build advanced physical and digital biomechanical models of disease.

This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.

www.me.iastate.edu