

Special MIE Seminar
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******* MEC 224 *******

**Bio-inspired Surgical and Soft Assistive Robots for Human Augmentation:
A Haptic Approach**

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Abstract

This talk presents two collaborative healthcare robotics innovations and their impact on translational medicine: Magnetic Resonance Imaging (MRI)-guided robots that augment surgeon manipulability for ultra-minimally invasive surgery and soft exoskeletons that augment human mobility.

The first part focuses on the design of MRI-compatible mechatronics that enables teleoperated robotic interventions with tentacle-like steerable robots. While robotics has revolutionized the standard of care for certain laparoscopic procedures, its impact has been limited by the soft tissue visualization and straight-line access requirement of many existing robotic systems. I will present a piezoelectric actuation approach that produces the least amount of MRI artifact during robot actuation. Then I will introduce a tentacle-like continuum robot that provides dexterous tissue manipulations. Those robots for MRI-guided prostate biopsy and neurosurgery have demonstrated its clinical efficacy through thirty human and animal trials. The second part presents control approaches of soft exoskeletons. Unlike conventional exoskeletons that are rigid and heavy, soft exoskeletons use soft materials to provide a conformal and unobtrusive means to interface to the human body. The talk describes control approaches that deliver biologically inspired assistance and how this tackles the grand challenges to reduce the human walking energetics.



Biography: *Hao Su, Ph.D., is a postdoctoral research fellow at Harvard University and the Wyss Institute for Biologically Inspired Engineering. Prior to this role, he was a Research Scientist at Philips Research North America where he designed robots for lung and cardiac surgery. He obtained the Ph.D. degree on Surgical Robotics from the Department of Mechanical Engineering at Worcester Polytechnic Institute. Dr. Su received the Best Medical Robotics Paper Runner-up Award in the IEEE International Conference on Robotics and Automation (ICRA) and Philips Innovation Transfer Award. He received the Advanced Simulation & Training Award from the Link Foundation and Dr. Richard Schlesinger Award from the American Society for Quality. He holds patents on surgical robotics and socially assistive robots.*

Dr. Su is a Junior Chair of the Technical Committee on Mechanisms and Design of the IEEE Robotics and Automation Society (RAS). He is the Associate Editor of the Journal: Frontiers in Robotics and AI. He is the Associate Editor of the IEEE International Conference on Robotics and Automation and the BioRobotics theme editor of the IEEE Engineering in Medicine and Biology Society (EMBC). He is the Exoskeleton Standardization Task Force member of the National Institute of Standards and Technology (NIST). He was the chair of Catheter Robotics workshop and organizing committee member of the Design of Medical Devices Conference.