Soft Robotics

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Overview: Robots – machines capable of assisting humans with tasks – will continue to grow in importance due to their importance in manufacturing, automation, and day-to-day tasks. Whereas conventional robots are built from rigid parts and rigid joints, humans and other organisms found in nature are built from primarily soft materials. The ability to build 'soft robots' is motivated by the need to have robots that can carry out delicate tasks (e.g. handling bread or picking fruit from plants) and interact safely with humans (e.g. grasping a hand or assisting the movement of disabled people). In addition to the prospect of being gentle, robots built from soft materials have a much greater degree of freedom of movement (an octopus is an exceptional example), which allows them to navigate complex pathways or grasp a variety of objects. This session will discuss the inspiration, opportunities, and challenges of such soft robots.

Session Description: Our first speaker, Prof. Rebecca Kramer, associate professor at Yale University, will give an overview of the field and identify challenges and opportunities. The second speaker, Dr Yigit Menguc of Facebook Reality Lab, will discuss the role of soft robotics in industry. The third speaker, Prof. Takyua Umedachi of Shinshu will discuss bioinspired robots; that is, robotics inspired from movements, mechanisms, and capabilities found in nature. The fourth speaker, Prof. Shingo Maeda from Shibaura University will discuss the importance of soft materials and chemistry in emerging robotics.

Specific questions to be addressed are: What are the most promising applications of soft robots? What are the grand challenges in the field? Are there concerns about the role of AI in robotics? What are emerging strategies to control soft robots? In what ways can we mimic nature and what ways can we not? In what ways should we mimic nature and what ways should we not? Do robots present any ethical challenges or concerns?

Session Speakers:

1. Rebecca Kramer, Associate Professor, Department of Mechanical Engineering, Yale University

Bio: Dr. Rebecca Kramer is an associate professor in the Department of Mechanical Engineering at Yale. She got her BS at Johns Hopkins, MS at University of California at Berkeley, and PhD at Harvard University in Rob Woods lab. Rebecca has received the ONY YIP Award, AFOSR YIP, NSF CAREER Award, NASA Early Career award, and is on the Forbes 30 under 30 list in 2015. Her research focuses on soft robots, actuators, and responsive materials

2. Yigit Menguc, Facebook Reality Lab, Oregon State University

Bio: Dr. Yiğit Mengüç is a research science manager at Facebook Reality Labs (FRL) and has a courtesy appointment in the Collaborative Robotics and Intelligent Systems (CoRIS) Institute at Oregon State

University. He received his B.S at Rice University, both his M.S. and PhD. at Carnegie Mellon University, then his postdoctoral training at Harvard University's Wyss Institute for Biologically Inspired Engineering. Dr. Menguc received the ONR YIP in 2016 and his lab had been funded by DARPA, NSF, Intel, HP, the Semiconductor Research Corporation, and Idaho National Labs before his move to FRL in 2017. His current research addresses integrated systems problems of soft wearable robotics.https://www.mlabrobotics.com/
https://www.beckman-foundation.org/people/yigit-menguc/

3. Takuya Umedachi , Shinshu University

Bio: Prof. Takuya Umedachi Ph.D. is a soft-roboticist inspired by primitive living organisms such as amoeba and caterpillars. His research focus on decentralized control (i.e., bio-inspired controller) and self-formation of soft-bodied animals, which are modeled and verified by developing robotic testbeds with digital fabrication (including 3D printing and printed electronics). He received a Ph.D. degree in Electrical and Communication Engineering from Tohoku University, in 2009.

2008 - 2010: Research Fellow of the Japan Society for the Promotion of Science (DC2) in the same lab.
2010 - 2011: Research Fellow of CREST, Japan Science and Technology under Prof. Ishiguro.
2011 - 2012: Research Fellow of the Japan Society for the Promotion of Science (PD), worked in the Department of Mathematical and Life Sciences, Hiroshima University
2012 - 2016: Worked in the Department of Biology, Tufts University under Prof. Barry A. Trimmer, editor-in-chief of the Journal of Soft Robotics
2016 - 2019: Project Lecturer at the Graduate School of Information Science and Technology, University of Tokyo.
2019 - present: Associate Professor at Faculty of Textile Science and Technology, Shinshu University.
https://scholar.google.co.jp/citations?user=3231cyMAAAAJ&hl=ja

4. Shingo Maeda, Associate Professor, Department of Engineering Science and Mechanics, Shibaura Institute of Technology (SIT)

Bio: Dr. Shingo Maeda is an associate professor in the Department of Engineering Science and Mechanics at SIT. He got PhD in physics and applied physics at Waseda University. He engaged in research at Scuola Superiore Sant' Anna as Visiting Professor. Shingo Maeda has received JTCF Novel Technology Paper Award for Amusement Culture and Hewlett-Packard most innovative paper award in IEEE IROS. His interests include soft robotics, chemical robotics, soft materials and nonlinear dynamics.