



Modelling and Control for Uncertain Robotic Systems: With applications in soft robot control and human-robot co-manipulation

Lecture by Marc Killpack (Brigham Young University)

Abstract

Over the last several years, our research group has worked to develop control and modeling methods for large-scale, deformable, pneumatic, robot manipulators. In parallel, we have also worked to understand how teams of human agents successfully communicate intent and reach consensus while co-manipulating large objects (in terms of volume, or mass, or both). In this talk, I will present a brief overview of soft robot control problem and the human-robot co-manipulation problem. Then I will share approaches (e.g. sampling-based MPC, learned models, adaptive control) that we have used in optimal control and machine learning to improve on state-of-the-art methods. We expect these advances to be essential for improving the performance of our soft robots for real-world tasks such as servicing satellites or space stations and working near human collaborators. However, we also expect these results for control of large degree-of-freedom, nonlinear, uncertain systems to extend beyond the field of soft robotics and human-robot collaboration. Finally, I will outline open questions that I hope will lead to potential collaborations at the Biorobotics Institute at the Scuola Superiore Sant'Anna.

Biography

Marc Killpack is an associate professor and has been in the department of **Mechanical Engineering at Brigham Young University** (BYU) since 2013. He was awarded a NASA Early Career Faculty award which has funded research on soft robots and control of underdamped robot arms. Further soft robot research is currently being funded under an NSF Emerging Frontiers in Research and Innovation award while research related to human-robot co-manipulation is supported by an NSF NRI award. Applications for high-performing soft robot include space

exploration and collaborative manipulation of heavy objects during disaster response or search and rescue operations. Marc completed his Ph.D. in Robotics from the Healthcare Robotics Lab (HRL) at the Georgia Institute of Technology. Prior to joining HRL, Marc completed Masters' degrees in Mechanical Engineering in 2008 from both Georgia Tech and AM ParisTech (formerly ENSAM) in Metz, France. In 2007, Marc graduated with a Bachelor of Science in Mechanical Engineering from Brigham Young University.

The seminar is managed by Brair Lab, coordinated by dot. Egidio Falotico

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16 May, 2023
HOUR
10 a.m.
WHERE
Aula 1, The BioRobotics Institute