

**Title:**

Sampling-based Optimal Control with Learned Models for Soft Robots

**Abstract:**

Model-based optimal control of large-scale soft robots is difficult for many reasons. Two of the main limitations are the difficulty of modeling such systems, and the tractability of the optimal control problem given the large number of degrees of freedom. First principle-based models can be difficult to derive and validate for soft robots. In addition, if the form of the soft robot platform changes, the method to model the platform may also need to change drastically. While any attempt to include additional states to improve the model accuracy also increases the complexity and decreases the tractability of the optimal control problem. In this talk, with an eye towards enabling multiple soft robots to coordinate motion for co-manipulation tasks, we present two approaches to solve these problems. First, we present learned models and DNN architectures that enable closed-loop optimal control of large-scale soft robots. Second, we present a sampling-based method to find high-quality solutions in a model predictive control formulation. Finally, we also present the limitations of this work and needed changes to reach the full potential of model-based control for soft robots.

**Bio:**

Marc Killpack is an associate professor in the department of Mechanical Engineering at Brigham Young University. 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 being funded under an NSF EFRI and NRI award. His current research interests relate to improving modeling and control for soft and compliant robots. This includes applications to space exploration, search and rescue, disaster response, and physical human-robot interaction. Marc completed his Ph.D. in Robotics from the Healthcare Robotics Lab (HRL) at the Georgia Institute of Technology. He also received a Masters' from Georgia Tech and AM ParisTech, and an undergraduate degree from BYU.