COLLEGE OF ENGINEERING
MECHANICAL ENGINEERING
UNIVERSITY OF MICHIGAN

Mechanical Engineering Seminar Series

Bilevel optimization for control, learning, and multi-contact robotics

Michael Posa

Assistant Professor of Mechanical Engineering
and Applied Mechanics

University of Pennsylvania

Tuesday, September 8, 2020

4:00 p.m.

ME Seminar Zoom link (QR Code below)

Password 5777

Abstract

Whether operating in a manufacturing plant or assisting within the home, many robotic tasks requires safe and controlled interaction with a complex and changing world. In this talk, I will present our recent progress on learning and control in contact rich settings. In the first segment, I will show how integrating the non-smooth structure of contact dynamics into a learning framework can dramatically improve accuracy and data efficiency when identifying or learning frictional dynamics. Our approach leads to a well-conditioned bilevel optimization problem, avoiding the numerical stiffness and inaccuracies that plague traditional approaches. In the second part of this talk, I will focus on the role of simple, low-dimensional models used in real-time planning for walking robots. Hand-engineered models, typically based in inverted pendulums, are widely used but lead to fundamental limitations on performance. Our recent work, leveraging trajectory optimization within bilevel optimization, to automatically synthesize simple models designed to succeed across a space of tasks. Time-permitting, I will also discuss our work on using bilinear matrix inequalities to leverage tactile feedback within provably stable control policies.

Bio

Michael Posa is an Assistant Professor in Mechanical Engineering and Applied Mechanics at the University of Pennsylvania. He leads the Dynamic Autonomy and Intelligent Robotics (DAIR) lab, a group within the Penn GRASP laboratory. His group focuses on developing computationally tractable algorithms to enable robots to operate both dynamically and safely as they quickly maneuver through and interact with their environments, with applications including legged locomotion and autonomous manipulation. Michael received his Ph.D. in Electrical Engineering and Computer Science from MIT in 2017, where, among his other research, he spent time on the MIT DARPA Robotics Challenge team. He received his B.S. in Mechanical Engineering from Stanford University in 2007. Before his doctoral studies, he worked as an engineer at Vecna Robotics in Cambridge, Massachusetts, designing control algorithms for the BEAR humanoid robot. He received the Best Paper award at Hybrid Systems: Computation and Control in 2013 and received a Google Faculty Research Award in 2018.

Karen Brown karenar@umich.edu

ME Seminar Series