Composable Optimization for Robotic Motion Planning and Control

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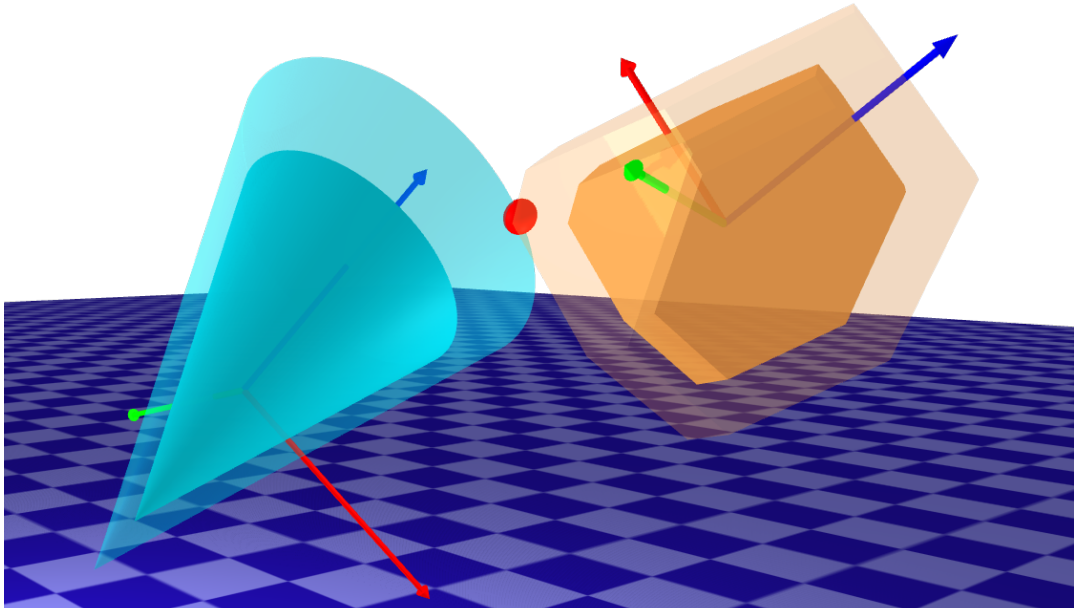
Abstract: Contact interactions are pervasive in key real-world robotic tasks like manipulation and walking. However, the non-smooth dynamics associated with impacts and friction remain challenging to model, and motion planning and control algorithms that can fluently and efficiently reason about contact remain elusive. In this talk, I will share recent work from my research group that takes an "optimization-first" approach to these challenges: collision detection, physics, motion planning, and control are all posed as constrained optimization problems. We then build a set of algorithmic and numerical tools that allow us to flexibly compose these optimization sub-problems to solve complex robotics problems involving discontinuous, unplanned, and uncertain contact mechanics.



Bio: Zac Manchester is an Assistant Professor of Robotics at Carnegie Mellon University. He holds a Ph.D. in aerospace engineering and a B.S. in applied physics from Cornell University. Zac was a postdoc in the Agile Robotics Lab at Harvard University and previously worked at Stanford, NASA Ames Research Center and Analytical Graphics, Inc. He received a NASA Early Career Faculty Award in 2018 and has led three satellite missions. His research interests include motion planning, control, and numerical optimization, particularly with application to robotic locomotion and spacecraft guidance, navigation, and control.