TECHNICAL COMMITTEE FOR

MODEL-BASED OPTIMIZATION FOR ROBOTICS

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2023-2024 TC Seminar Series

Zoom: https://columbiauniversity.zoom.us/j/91247893326?pwd=L2JWU21aQzc4cU1ZQklEb0QrWGQvdz09

Time: *March 14th, 2024, 9 AM EST*

Prof. Ludovic Righetti
New York University (NYU)

Learning complex behaviors with nonlinear MPC

Abstract:

Nonlinear model predictive control (MPC) is a reliable technology to generate a variety of robotic behaviors, from flying robots to humanoids. While MPC is a rigorous framework to generate, in principle, any kind of behavior from a single algorithm, major limitations remain. For example, current approaches do not allow easy inclusion of multi-modal sensing, especially visual and force feedback, and algorithms struggle to optimize in real-time multi-contact behaviors necessary for complex manipulation or locomotion. On the other hand, learning-based methodologies, which heavily rely on offline compute, do not seem to struggle with these issues. In this talk, I will present our recent work tackling those problems with a particular eye towards unifying learning and numerical optimal control. First, I will argue for the benefits of "textbook" numerical optimization methods to develop reliable solvers. Then I will discuss how to include multi-modal sensing and accelerate the computation of multi-contact behaviors through a mixture of offline compute (learning) and online optimization (MPC). I will then show how this can lead to improved performance for movement generation in the context of locomotion and manipulation and discuss on-going challenges.

Biography:

Ludovic Righetti is an Associate Professor in the Electrical and Computer Engineering Department and in the Mechanical and Aerospace Engineering Department at the Tandon School of Engineering of New York University. He holds an Engineering Diploma in Computer Science and a Doctorate in Science from the Ecole Polytechnique Fédérale de Lausanne. He was previously a postdoctoral fellow at the University of Southern California and a group leader at the Max-Planck Institute for Intelligent Systems. His work has received several awards including the 2010 Georges Giralt PhD Award, the 2011 IROS Best Paper Award, the 2016 IEEE RAS Early Career Award and the 2016 Heinz Maier-Leibnitz Prize from the German Research Foundation. His research focuses on the planning, control and learning of movements for autonomous robots, with a special emphasis on legged locomotion and manipulation.