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Date: Friday, September 4, 2026

Time: 12:00 to 1:00 PM

Location: SR2 130

Title: Data-enabled neural multi-step predictive control for automated insulin delivery in type 1 diabetes

Abstract: Type 1 Diabetes (T1D) is a chronic disease characterized by the complete loss of endogenous insulin secretion due to autoimmune destruction of pancreatic beta-cells. Consequently, glycemic regulation is based on exogenous subcutaneous insulin administration. A technological solution for the automated management of the disease has been sought for decades, and as a result, over the past few years, a number of glucose control devices have been granted regulatory approval. However, while commercially available systems, denoted as "hybrid closed-loop" provide good automatic glucose control overnight, when no disturbances are acting on glucose metabolism, they still require users to make multiple, complex high-stakes therapeutic decisions each day, by performing carbohydrate counting, manually entering prandial insulin boluses, managing treatments around exercise, stress, and sick days; and provide little to no settings customization nor adaptability of the controller to the specific metabolic state of the patient. Even with the state-of-the-art devices, insulin replacement therapy is burdensome, and consequently, patients not only fail to meet their recommended glycemic targets but are also strained mentally.

In this presentation, I will explore an alternative approach to personalized, adaptive, and fully automated closed-loop glucose control. First, I will introduce the use of neural multi-step-ahead predictors, identified from data, within a receding-horizon optimal control framework. Next, I will discuss an adaptive input penalty framework for the calibration of the resulting controller aggressiveness that is tailored to the metabolic state of the patient. Last, I will present results from in-silico trials demonstrating the successful application of this framework to personalized and adaptive automated insulin delivery for glucose regulation in a population of 10 virtual subjects with T1D.

Bio: Marzia Cescon is the David C. Zimmerman Associate Professor of Mechanical and Aerospace Engineering at the University of Houston (UH). At UH she is also founder and director of the Advanced Learning, Artificial Intelligence and Control laboratory, a multidisciplinary effort for learning-based decision making and control of complex and potentially unknown dynamical systems. Dr. Cescon earned a bachelor's degree in information engineering and a master's degree in control systems engineering from the University of Padua, Italy, and received a Ph.D. in automatic control from Lund University, Sweden. She has held several research positions, including at the University of California at Santa Barbara, the University of Melbourne, and Harvard University. Dr. Cescon is the recipient of the Cornelis Drebber Faculty Fellowship from TU Delft (2023), the NSF Career Award (2024), the Cullen College of Engineering Early Inventor Award (2025), the ASME Rising Star in Mechanical Engineering Award (2025), and the University of Houston Rising Innovator Faculty Award (2026).