Northeastern University
College of Engineering

February 7, 2024 | Churchill Hall 103 | 12:00PM

Distinguished Seminar Speaker

Optimal Control as a Catalyst for Smart and Sustainable Systems

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Abstract: Sustainability is crucial in modern engineering, particularly in chemical and biological systems. It involves the use of sustainable resources and the development of environmentally friendly, smart, and efficient systems that minimize waste and optimize resource use. Central to engineering smart, sustainable systems is optimal control. However, integrating optimal control technologies into these systems is challenging due to the complexity of managing large-scale, constrained, nonlinear, and interconnected subsystems, particularly under uncertain conditions. In this talk, I will introduce a series of optimal control technologies that contribute to smarter and more efficient systems, enhancing their sustainability. Specifically, I will discuss the development and application of (1) model predictive control and (2) reinforcement learning, which are instrumental in engineering systems that use minimal resources and generate less waste. I will also demonstrate how optimal control is pivotal in advancing sustainable food production in urban areas through the integration of renewable energy and efficient resource management. These advances in optimal control are critical in developing smart, sustainable systems and are essential for a sustainable future.

Biography: Benjamin Decardi-Nelson is an Eric and Wendy Schmidt AI in Science Postdoctoral Fellow in Systems Engineering at Cornell University. Benjamin's research interest in Process Systems Engineering centers around developing novel computational tools to improve the analysis, design and control of complex processes and systems, with the overarching goal of sustainability. Prior to joining Cornell, he earned his PhD in Process Control from the University of Alberta, where he developed efficient algorithms and large-scale optimization models for integrated real-time economic optimization and advanced process control of nonlinear process systems. At Cornell, Benjamin integrates biology-informed AI with optimization to decarbonize future food systems through implicit learning of plant-environment interactions, and renewable energy integration. His work has been recognized by the Schmidt AI in Science postdoctoral fellowship, Natural Sciences and Engineering Research Council of Canada (NSERC) postdoctoral fellowship, among others.

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