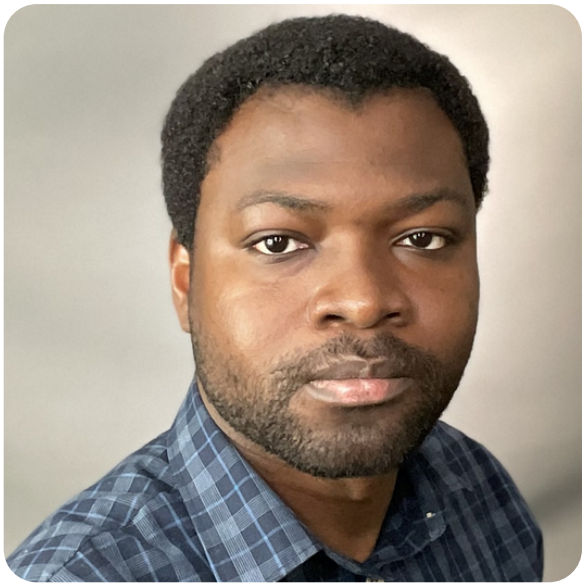
Penn Engineering
University of Pennsylvania
Chemical and Biomolecular Engineering

Spring 2024 Seminar Series

BENJAMIN DECARDI-NELSON

"Optimal Control as a Catalyst for Smart and Sustainable Systems"

Wednesday
January 31, 2024
3:30 PM
Wu and Chen Auditorium
Levine Hall



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ABSTRACT

In modern engineering, sustainability is a crucial aspect, especially in chemical and biological process systems. This concept has evolved to encompass a holistic approach, emphasizing not only the use of sustainable resources but also the development of systems that are environmentally friendly, smart, and efficient. Such systems aim to minimize waste and optimize resource use. At the heart of this shift is optimal control, a fundamental element in engineering smart, sustainable systems. However, the integration of 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 creating 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. Overall, these advancements in optimal control techniques illustrate their transformative role in shaping the future of intelligent, sustainable systems, underscoring their vital importance in our path toward a more sustainable world.

BIO

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.