

SPRING 2026 SEMINAR SERIES

Responsive & Resilient AI for

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Autonomous Systems Engineering

Move Fast, but Don't Break Things: Safe and Robust Control for Reliable Autonomy

Dr. Leila Bridgeman
Duke University

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Electrical & Computer Engineering, Rm. 118

Abstract

Machine learning and ubiquitous connectivity have brought leaps in performance in many areas. Yet reliable autonomy demands progress in control theory to safely embody complex algorithms in physical systems, like robots, vehicles, drones, and infrastructure, that must function despite changing environments, shifting configurations, and uncertain dynamics. Traditional robust control addresses uncertainty, but its conservatism limits the high functionality envisioned for modern autonomy. On top of this, learned controllers often lack explicit models, the foundation of classical control. This talk will present new, foundational results that enable control designs with both high performance and reliability while confronting intersecting challenges from nonlinear dynamics, uncertainty, and complex interconnections. We'll explore applications to drone coordination, mechanical systems, and automated tumor resection.

Speaker Bio

Leila Bridgeman is an assistant professor of Mechanical Engineering and Materials Science at Duke University. She earned B.Sc. and M.Sc. degrees in Applied Mathematics in 2008 and 2010 from McGill University, Montreal, QC, Canada, where she completed her Ph.D. in Mechanical Engineering, earning McGill's 2016 D.W. Ambridge Prize for outstanding dissertation in the physical sciences and engineering. She was a recipient of a 2023 ONR Young Investigator Prize.

Through her research, Leila strives to bridge the gap between theoretical results in robust and optimal control and their use in practice. She explores how the tools of numerical analysis, input-output stability theory, and set invariance can be applied through practical, computationally-tractable algorithms. Resulting publications have considered applications of this work to robotic, process control, and time-delay systems and the development of autonomous ultrasound and laser actuated robotics.



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