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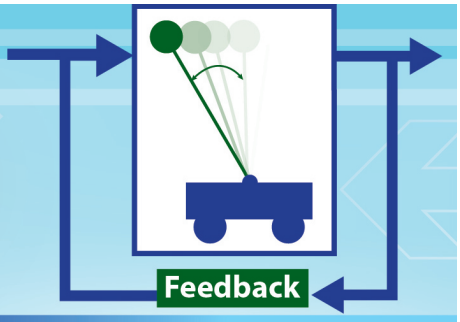
Control Seminar



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Probabilistic Safety Via Stochastic Reachability: application to autonomous systems and to physiological systems

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Friday, September 22, 2017

3:30 – 4:30 pm • 1500 EECS

ABSTRACT: Assurances of safety in autonomous systems are complicated by stochasticity, from human-on-the-loop actions, disturbance effects, and inevitable limitations in mathematical models. Nascent theoretical results have been limited by computational complexity, as the underlying solution is based on dynamic programming with a multiplicative cost function. We describe an approach based in Fourier transforms, which provides an exact solution for uncontrolled systems, and an underapproximation for systems with a control input. This method enables high dimensional stochastic viability and reachability calculations, and has been applied to problems in collaborative robot navigation, dynamic target capture, satellite rendezvous and docking, and circadian entrainment. Applying these methods to physiological systems is complicated by characterization of the underlying dynamical system. We describe efforts to characterize feedback mechanisms in Parkinson's disease, with the ultimate goal of synthesizing probabilistically safe controllers to mitigate motor symptoms. When coupled with methods for characterization of human action and response, methods for probabilistic safety could form the basis for analysis and design of high-dimensional human-in-the-loop systems.

BIO: Meeko Oishi is an Associate Professor of Electrical and Computer Engineering at the University of New Mexico. She received the Ph.D. (2004) and M.S. (2000) in Mechanical Engineering from Stanford University, and a B.S.E. in Mechanical Engineering from Princeton University (1998). Her research interests include hybrid dynamical systems, control of human-in-the-loop systems, reachability analysis, and modeling of motor performance and control in Parkinson's disease. She previously held a faculty position at the University of British Columbia at Vancouver. She is the recipient of the NSF CAREER Award, the UNM Regents' Lecturer Award, the UNM Teaching Fellowship, the Peter Wall Institute Early Career Scholar Award, the Truman Postdoctoral Fellowship in National Security Science and Engineering, and the George Bienkowski Memorial Prize, Princeton University. She was a Summer Faculty Fellow at AFRL Space Vehicles Directorate 2013–2015.

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