



MECHANICAL ENGINEERING SEMINAR

Monday, January 11 2027 at 14:30, D. Dan and Betty Kahn Building, Auditorium 1

Second-Moment Stability Boundaries for LTI SDDEs

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Hosted by: Prof. Oleg Gendelman

This talk describes the derivation of optimal, semi-analytic, algebraic equality conditions that can be used to identify second-moment stability boundaries in linear, time-invariant stochastic delay-differential equations with a single constant delay and both multiplicative and additive noise, without the use of problem discretization. As illustrated for applications in robot control and machine tool vibrations, such boundaries define critical parameter combinations beyond which the accumulated influence of noise results in local exponential growth of variance even before any instability is visible in the mean. The predictions of closed-form analysis and numerical parameter continuation are successfully validated against Monte Carlo simulations and published results for several low-dimensional models, helping to clarify limitations of stability conditions proposed in the literature and demonstrating considerable savings in computational effort relative to discretization-based approaches.

Bio:

Since January 2024, Dr. Harry Dankowicz is Professor of Mechanical Engineering in the A. James Clark School of Engineering at the University of Maryland, College Park. He graduated from KTH Royal Institute of Technology in Stockholm, Sweden, with an M.Sc. in Engineering Physics in 1991 and, subsequently, from Cornell University with a Ph.D. in Theoretical and Applied Mechanics in 1995. Following post-doctoral and research associate appointments at KTH between 1995 and 1999, Dankowicz joined the Department of Engineering Science and Mechanics at Virginia Polytechnic Institute and State University, where he remained until 2005 when he became a faculty member in the Department of Mechanical Science and Engineering at the University of Illinois at Urbana-Champaign. Dr. Dankowicz is a Fellow of the ASME and a recipient of a PECASE award from the US National Science Foundation. His research interests include design, modeling, analysis, and control of nonlinear devices and systems; development of computational tools for bifurcation analysis, uncertainty quantification, and constrained design optimization of nonlinear systems, including those with time delays, discontinuities, and noise; and foundational techniques in ML/AI-based digital twinning for real-time control and prognostication. He is the lead developer of the COCO software package and author of textbooks on multibody mechanics and visualization, chaotic dynamics in Hamiltonian systems, and parameter continuation techniques.