

**University of Rochester**  
**Department of Electrical and Computer Engineering Colloquia**

**Uncertainty-Aware and Data-Driven Design Verification for Nanoscale Systems  
and Multi-Domain Applications**

**Dr. Zheng Zhang**

**Wednesday, March 22nd**  
**12:00 PM – 1:00 PM**  
**Computer Studies Building (CSB) 209**

**Abstract:** Uncertainties can cause significant performance degradations and functional failures in numerous engineering systems. Examples include (but are not limited to) nanoscale devices and systems with fabrication process variations, robot control without full knowledge of design or environmental parameters, energy systems with weather-dependent renewable energy sources, and magnetic resonance imaging (MRI) with incomplete and noisy scanning data. Modeling, controlling and optimizing these problems are generally data-intensive: one has to generate and analyze a huge amount of costly data in a parameter space. This often leads to the notorious curse of dimensionality: the complexity grows extremely fast with the number of uncertainty or/and design parameters. This talk presents some fast non-Monte-Carlo techniques to verify the performance of uncertain engineering systems. These techniques can accelerate a lot of uncertainty-aware optimization, control and data inference tasks (e.g., yield optimization of silicon chips, robust control of robots and power systems, electrical property tomography using MRI data). The first part will present some fast algorithms to simulate nonlinear dynamic systems influenced by a small number of uncertain parameters. The second part will present some high-dimensional algorithms to predict the performance uncertainties of an engineering system influenced by many random parameters. The main application is variability analysis of nanoscale IC, MEMS and integrated photonics. Other application examples (e.g., energy systems and MRI) will also be demonstrated.

**Bio:** Zheng Zhang is a postdoc associate with MIT, where he received his Ph.D. degree in Electrical Engineering and Computer Science in 2015. He is interested in high-dimensional uncertainty analysis and data inference for diverse engineering problems, including nanoscale devices and systems, hybrid systems (e.g., power systems and robots) and MRI. Dr. Zhang received the 2016 ACM Outstanding PhD Dissertation Award in Electronic Design Automation, the 2015 Doctoral Dissertation Seminar Award from the Microsystems Technology Laboratory of MIT, and the 2014 Best Paper Award from IEEE Transactions on CAD of Integrated Circuits and Systems. He is a TPC member of Design Automation Conference (DAC) and International Conference on Computer-Aided Design (ICCAD).

Pizza and soda provided.