SYSTEMS INSTITUTE
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DoGEE-E^{2}SHI-SI seminars

12-1:30pm: Importance Sampling for Reliability Evaluation with Stochastic Computer Models

Importance sampling has been used to improve the efficiency of simulations where the simulation output is uniquely determined, given a fixed input. We extend the theory of importance sampling to estimate a system's reliability with stochastic simulations. Thanks to the advance of computing power, stochastic computer models are employed in many applications to represent a complex system behavior. In a stochastic computer model, a simulator generates stochastic outputs at the same input. Given a budget constraint on the total simulation replications, we develop a new approach that efficiently uses stochastic simulations with unknown output distribution. Specifically, we derive the optimal importance sampling density and allocation procedure that minimize the variance of an estimator. Application to a computationally intensive aeroelastic wind turbine simulation demonstrates the benefits of the proposed approach.

1:30-3pm: Data-driven Modeling and Analysis for Wind Power Systems

To quantify and minimize the uncertainties in the design and operational stage, we model and analyze the dependency of wind turbine responses (e.g., power generation, loads and condition monitoring sensor measurement) on operating conditions and the interactions among turbines. Our research entails several areas: (a) Adaptive predictions: Wind turbine responses show time-varying dependency on weather conditions due to external (e.g., dust/insect accumulation on blades) and internal (e.g., component degradation) factors. For such a nonstationary process, a single baseline curve may not accurately characterize the system's dynamic behavior. We develop kernel-based, nonparametric regression models that can dynamically track changes in the operational wind power system; (b) Condition monitoring: Condition monitoring helps reduce the operations and maintenance costs by providing information about the physical condition of wind power systems. We model the wind turbine response as a function of weather variables and determine the decision boundaries to distinguish faulty conditions from normal conditions by examining the variations in the operational responses; and (c) wake effect quantification: The performance of downstream turbines can be significantly decreased due to the wake effect among wind turbines. We model and analyze the interactions among wind turbines to quantify the power deficit due to wake effects.

Dr. Eunshin Byon is an Assistant Professor in the Department of Industrial and Operations Engineering at the University of Michigan, Ann Arbor, USA. She received her Ph.D. degree in Industrial and Systems Engineering from the Texas A&M University, College Station, USA, and joined the University of Michigan in 2011. Dr. Byon's research interests include reliability evaluation and optimal control for stochastic systems, predictive modeling and data analytics. Her recent research focuses on structural load modeling, operation and maintenance (O&M) optimization, and condition monitoring in wind power systems.

Date: Tuesday, Mar 3, 2015

12pm-1:30pm **and** 1:30pm-3pm

Location: Ames Hall, Room 302

This event is free and open to the public

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