

Department of Systems Engineering and Engineering Management

Seminar Series

Some Statistical Aspects of Uncertainty Quantification

Prof. Peter QIAN

University of Wisconsin-Madison, USA

Date	19 December 2016 (Monday)
Time	10:30am - 11:30am
Venue	G5316, 5/F, AC1

Abstract

Computer simulations, such as computational fluid dynamics, finite element analysis, discrete element models, agent-based models and multi-physics codes, are widely used in automotive, aerospace, turbomachine, nuclear engineering, finance, marketing and many other fields. These simulations are necessary for studying complex phenomena as varied as thermal dynamics, aircraft-controller interaction, and cooling efficiency. Unfortunately, simulation models are never perfect and various uncertainties, including random initial and boundary conditions, input uncertainty, and model discrepancy, can produce misleading results. Thus, it is necessary to develop a rigorous mathematical framework for uncertainty quantification (UQ). UQ is an emerging field in applied mathematics, statistics and engineering.

This talk will discuss several statistical aspects of UQ. First, a new class of scalable statistical design is demonstrated. These designs have overlapping components and are useful for cross-validating data and models from multiple sources. Second, a new theoretical framework is presented to shed light on the statistical and numeric trade-off of gradient-enhanced emulators. Third, a new kernel-based model is developed for emulation of simulation models with structural invariance that frequently appear in material science, physics and biology. Fourth, a new statistical method is introduced to efficiently solve optimization under uncertainty problems. The key of the method is to embed negative dependence among multiple batches in sample average approximations to achieve variance reduction.

About the Speaker

Dr. Peter Qian is a professor in the Department of Statistics and the Department of Industrial and Systems Engineering at the University of Wisconsin-Madison. His research has been primarily focused on big data analytics, uncertainty quantification and design of experiments. He has served on the editorial boards of Annals of Statistics, SIAM/ASA Journal of Uncertainty Quantification and other journals. He has received a National Science Foundation Career Award and an IBM Faculty Award.

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All are Welcome!

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