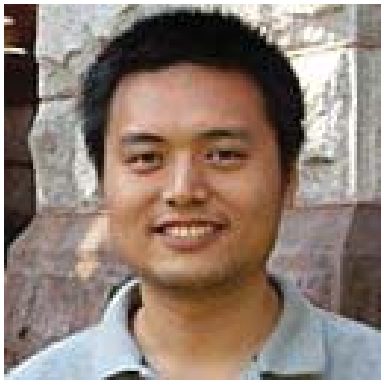
College of Arts and Sciences
Department of Mathematics
University of South Carolina

Math Colloquium

Uncertainty Quantification for Complex Systems using Limited Data

Xiu Yang, PNNL



Tuesday
February
20th

4:30 PM
LeConte 412

Realistic analysis and design of complex engineering systems require not only a fine understanding of the underlying physics, but also a significant recognition of uncertainties and their influences on the quantities of interest. Intrinsic variabilities and lack of knowledge about system parameters or governing physical models often considerably affect quantities of interest and decision-making processes. For complex systems, the available data for quantifying uncertainties or analyzing sensitivities are usually limited because the cost of conducting a large number of experiments or running many large-scale simulations can be prohibitive. Efficient approaches of representing uncertainties using limited data are critical for such problems. I will talk about two approaches for uncertainty quantification by constructing surrogate model of the quantity of interest. The first method is the adaptive functional ANOVA method, which constructs the surrogate model hierarchically by analyzing the sensitivities of individual parameters. The second method is the sparse regression based on identification of low-dimensional structure, which exploits low-dimensional structures in the parameter space and solves an optimization problem to construct the surrogate models. I will demonstrate the efficiency of these methods with PDE with random parameters as well as applications in aerodynamics and computational chemistry.

UNIVERSITY OF SOUTH CAROLINA