Department of Applied and Computational Mathematics and Statistics Colloquium

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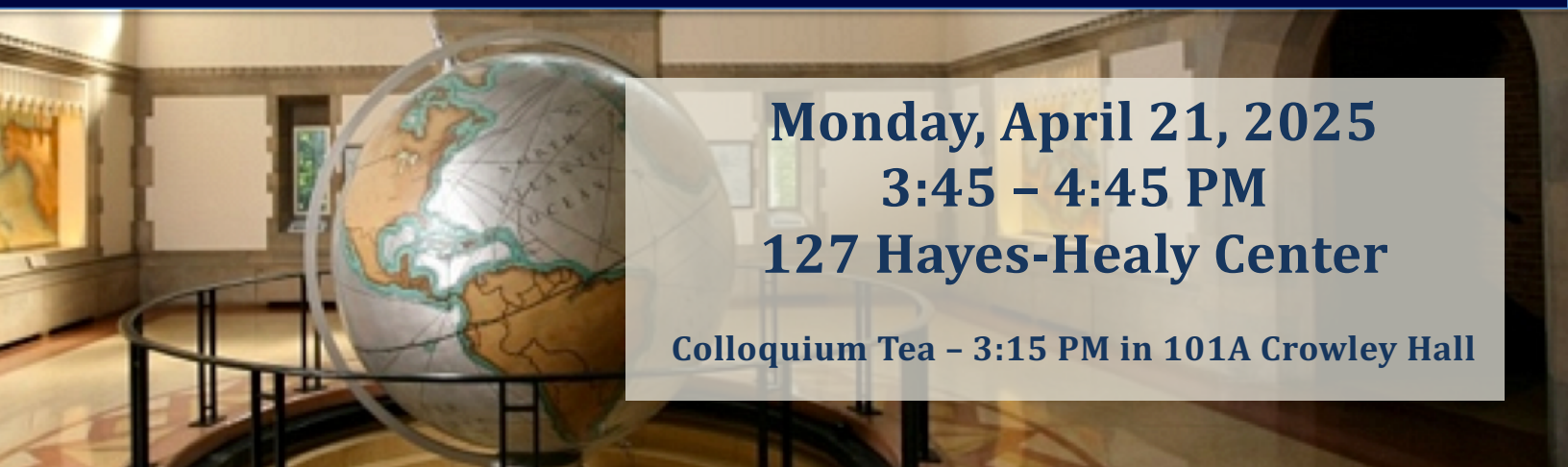
Deviations from the Beaten Track in Multi-Fidelity Uncertainty Quantification: A Brief Journey from Non-Hierarchical Estimators to More Advanced Topics

Multi-fidelity (MF) uncertainty quantification (UQ) refers to the broad collection of techniques that fuse data from multiple information sources to accelerate various UQ tasks for computational expensive models. During the first decade of 2000s, the interest in these techniques exploded motivated by the need to apply UQ to state-of-the-art scientific and engineering simulations whose computational requirements prohibit the evaluation of large collections of samples. Significant progress was made in this area starting from the seminal multi-level Monte Carlo contributions by Heinrich and Giles and, more recently, with approaches like Multi-Fidelity Monte Carlo, Approximate Control Variate, and Multi-Level Best Linear Unbiased Estimators. Despite these advancements, the vast majority of the literature has devoted limited attention to challenges that naturally emerge when dealing with realistic features in computational applications. For instance, the bulk of the literature has focused on hierarchical methods, i.e., methods that are capable of exploiting strict sequences of models, while, in practice, an a priori ordering of the information sources is often impossible. Furthermore, less canonical scenarios, like the presence of models described by non-deterministic solvers (i.e., computational approaches that may produce a different output given the same input) or the presence of models with dissimilar parametrizations (i.e., models that only share a subset of the input parameters), are not often discussed. As a consequence, at the state-of-the-art, a number of challenges in MF UQ remain poorly explored. In this talk, I will provide some background on MF UQ methods and I will illustrate some of the topics at the forefront of this research area.



Monday, April 21, 2025
3:45 – 4:45 PM
127 Hayes-Healy Center

Colloquium Tea – 3:15 PM in 101A Crowley Hall