Joint Seminar - Structural Engineering and SRIS

CEE595 S and SRIS

Surrogate modeling approaches to enable uncertainty quantification in mechanics application

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Abstract:

Structural design is traditionally performed with a pre-specified material in mind, creating a structural configuration that meets performance requirements in the context of that material. With recent advances in materials by design, one begins to wonder if the material itself could be designed in concert with the structure. In other words, given a target performance, the design optimization would simultaneously consider the structure and the material. The key step in this optimization will be to define an objective function that includes both the material (such as microstructural descriptors) and the structure (such as geometry and boundary conditions). While such an objective function might be formulated explicitly with multi-scale models, typically for real structures and materials this approach would be computationally infeasible. Surrogate functions, which are a simplified representation of the material, provide a much more efficient alternative. However, these surrogate functions can lead to a number of challenges. If the material is represented by a large number of microstructural parameters, then the high dimensionality of the surrogate function requires many samples in order to be built. Furthermore, some micro-scale behavior, such as sudden damage or failure, can lead to discontinuous surrogate functions, which makes it difficult to interpolate or collocate the results. This seminar will describe a number of approaches to building surrogates, including cases in which the micro-scale model provides key response values and/or gradients of key response values.

Bio:

Lori Graham-Brady is Professor and Chair of the Civil Engineering Department at Johns Hopkins University, with secondary appointments in Mechanical Engineering and Materials Science & Engineering. Her research interests are in computational stochastic mechanics, multiscale modeling of materials with random microstructure and the mechanics of failure under high-rate loading. She is the Associate Director of the Hopkins Extreme Materials Institute and previous Director of an NSF-funded IGERT training program with the theme of Modeling Complex Systems. She has received a number of awards, including the Presidential Early Career Awards for Scientists and Engineers (PECASE), the Walter L. Huber Civil Engineering Research Prize, and the William H. Huggins Award for Excellence in Teaching.

Monday, September 23rd, 2019 4:00 – 5:00 p.m.

1310 Yeh Student Center