MAE Seminar Series

Uncertainty quantification techniques for structural systems with random material properties

Thursday,
May 3
3:30 pm
Knox 110

Dr. Ramakrishna Tipireddy
Scientist, Physical and Computational Sciences Directorate, Pacific Northwest National Laboratory

ABSTRACT

In this talk I will present a stochastic dimension reduction method developed at PNNL based on the basis adaptation in combination with the spatial domain decomposition method for partial differential equations (PDEs) with random coefficients. We use polynomial chaos based uncertainty quantification (UQ) methods to solve stochastic PDEs and model random coefficient using Hermite polynomials in Gaussian random variables. In this approach, we decompose the spatial domain into a set of non-overlapping subdomains and find in each subdomain a low-dimensional stochastic basis to represent the local solution in that subdomain accurately. The local basis in each subdomain is obtained by an appropriate linear transformation of the original set of Gaussian random variables spanning the Gaussian Hilbert space. The local solution in each subdomain is solved independently of each other while the continuity conditions for the solution and flux across the interface of the subdomains is maintained. We employ Neumann-Neumann algorithm to systematically compute the solution in the interior and at the interface of the subdomains. To impose continuity, we project local solution in each subdomain onto a common basis. We show with the numerical experiments that the proposed approach significantly reduces the computational cost of the stochastic solution.

BIO SKETCH

Ramakrishna Tipireddy is a Scientist in the Physical and Computational Sciences Directorate at the Pacific Northwest National Laboratory. His research interests include uncertainty quantification, computational mechanics, and development of reduced order models for complex stochastic systems. Tipireddy received his PhD in Civil Engineering from University of Southern California. Contact him at Ramakrishna.Tipireddy@pnnl.gov.

University at Buffalo
Department of Mechanical and Aerospace Engineering
School of Engineering and Applied Sciences