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Frontiers of Scientific Computing Lecture Series

Efficient Solution Algorithms for Stochastic Partial Differential Equations

Howard Elman, University of Maryland

Professor

Digital Media Center 1034
October 16, 2014 - 03:30 pm**Abstract:**

We consider new computational methods for solving partial differential equations (PDEs) when components of the problem such as diffusion coefficients or boundary conditions are not known with certainty but instead are represented as random fields. In recent years, several computational techniques have been developed for such models that offer potential for improved efficiencies compared with traditional Monte-Carlo methods. These include stochastic Galerkin methods, which use an augmented weak formulation of the PDE derived from averaging with respect to expected value, and stochastic collocation methods, which use a set of samples relatively small in cardinality that captures the character of the solution space. We give an overview of the relative advantages of these two methods and present efficient computational algorithms for solving the algebraic systems that arise from them. In addition, we show that these algorithms can be combined with techniques of reduced-order modeling to significantly enhance efficiency with essentially no loss of accuracy.

Speaker's Bio:

Howard Elman is a Professor in the Computer Science Department and the Institute for Advanced Computer Studies at the University of Maryland, College Park. He received his doctorate in Computer Science from Yale University in 1982. He has had visiting positions at Stanford University, the University of Manchester Institute of Science and Technology, and the University of Oxford. He has been selected as a SIAM Fellow and serves on the SIAM Committee on Science Policy and SIAM Financial Management Committee.

He has served on the editorial boards of SIAM Journal on Scientific Computing, where he was editor-in-chief from 1998-2004, Mathematics of Computation, and Numerical Linear Algebra with Applications. His book "Finite Elements and Fast Iterative Solvers" (coauthored with D. J. Silvester and A. J. Wathen) is published by Oxford University Press. His research concerns numerical solution of partial differential equations, computational fluid dynamics, sparse matrix methods, and uncertainty quantification.

This lecture has refreshments @ 03:00 pm