Texas Tech University. Applied Mathematics Seminar.

Solution Strategies for the Stochastic Steady-state Diffusion Problem

Sarah Osborn, *Texas Tech University*

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ABSTRACT. When using partial differential equations, the exact values of the boundary and initial conditions as well as the equation coefficients are often not known exactly and need to be treated with uncertainty. We consider the numerical solution of a stochastic steady-state diffusion problem where the diffusion coeffcient is a random field. The stochastic Galerkin finite element method is used to discretize the problem in both spatial and stochastic dimensions using polynomial chaos expansions. The resulting large linear system is solved with preconditioned Krylov iterative methods which involves many matrix-vector multiplications. These matrix-vector multiplications can be viewed as multiplication of truncated polynomial chaos expansions. Also, division of truncated polynomial chaos expansions is necessary for the preconditioners that are used. In this talk, we consider methods of computing quotients of polynomial chaos expansions and present results for how this affects the overall speed of computing the numerical solution of the stochastic diffusion equation. This is research that was done during a summer internship at Sandia National Laboratories, Albuquerque, NM.