Texas Tech University - Department of Mathematics and Statistics
Seminar in Applied Mathematics

# Preconditioning Techniques for Stochastic Galerkin Discretizations of PDEs with Random Data

SARAH OSBORN

*Texas Tech University*

**Wednesday, October 22, 2014**
**Room: MATH 114. Time: 4:00pm.**

**ABSTRACT.** When using partial differential equations (PDEs) to model physical problems the exact values of coefficients are often unknown. To obtain more realistic models, the coefficients are typically treated as random variables in an attempt to quantify uncertainty in the underlying problem. Stochastic Galerkin methods are used to obtain numerical solutions for these types of problems. These methods couple the stochastic and deterministic degrees-of-freedom and yield a large system of equations that must be solved. A challenge in this method is solving the large system accurately and efficiently. Typically the system is solved iteratively and preconditioning strategies dictate the performance of the iterative method. Our goal in this work is to improve solver efficiency by investigating preconditioning techniques and solver implementation details. Several preconditioners have been proposed that offer satisfactory performance for certain problems. In particular, we consider an algebraic multigrid preconditioner. The effects on the convergence rate are theoretically and experimentally studied when using different coarse grid solvers and approximations in the multigrid scheme. Also, alternative formulations of the multigrid hierarchy are proposed and studied. Another improvement to the solution strategy is to consider implementation of standard solution approaches on emerging computational architectures. We then present some numerical results to illustrate the performance of the proposed implementation and algorithmic changes.