

TEMPLE UNIVERSITY  
Department of Mathematics

# Applied Mathematics and Scientific Computing Seminar

Room 617 Wachman Hall

Wednesday, 24 April 2013, 4:00 p.m.  
(tea and social at 3:45)

## Multigrid Preconditioners for Linear Systems Arising in PDE-Constrained Optimization

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**Abstract.** We discuss the problem of finding optimal order multigrid preconditioners for linear systems involved in the solution process of large-scale, distributed optimal control problems constrained by partial differential equations. Multigrid methods have long been associated with large-scale linear systems, the paradigm being that the solution process can be significantly accelerated by using multiple resolutions of the same problem. However, the exact embodiment of the multigrid paradigm depends strongly on the class of problems considered, with multigrid methods for differential equations (elliptic, parabolic, flow problems) being significantly different from methods for PDE-constrained optimization problems, where the linear systems often resemble integral equations. In this talk we present a number of model problems for which we were able to construct optimal order multigrid preconditioners, as well as problems where we have been less successful. The test problems include (a) linear and semi-linear elliptic constrained problems, (b) optimal control problems constrained by fluid flow (both (a) and (b) without control-constraints), and (c) control-constrained problems with linear-elliptic PDE constraints.