TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Wednesday, 18 November 2015, 4:00 p.m.
Room 617 Wachman Hall

(refreshments and social at 3:45 p.m)

Block Preconditioners for Parabolic Optimal Control Problems

by Christian Schaerer
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Abstract. Large scale linear quadratic optimal control problems subject to parabolic partial differential equations arise in many engineering applications. In this talk, I will discuss some block matrix algorithms for its iterative solution over a finite control horizon.

The spatial discretization using finite element methods yield a large system of equations. Its solution by conventional control algorithms can be prohibitively expensive in terms of computational cost and memory requirements. In this talk, I will describe some algorithms. The first of them employs a CG method to solve a symmetric positive definite reduced linear system for the unknown control variable. The advantage of this algorithm is that its has a rate of convergence independent of the space and time discretization parameters, but double iteration is required.

A second algorithm is designed to avoid double iteration by introducing an auxiliary variable, yielding a symmetric indefinite system. For this system a positive definite block preconditioner is described. We prove that the resulting rate of convergence is independent of the space and time discretization parameters, when MINRES acceleration is used. Numerical results are presented for test problems.