Texas Tech University. Applied Mathematics Seminar.

Theoretical and Computational Issues in Control of a Thermal Fluid

Weiwei Hu

Interdisciplinary Center for Applied mathematics, Virginia Tech

Wednesday, October 5, 2011

Room: MATH 010. Time: 4:00pm.

ABSTRACT. In this talk, we present theoretical and numerical results for a feedback control problem defined by a thermal fluid. The problem is motivated by recent interest in designing and controlling energy efficient building systems. In particular, we show that it is possible to locally exponentially stabilize the nonlinear Boussinesq Equations by applying Neumann/Robin type boundary control on a bounded and connected domain. The feedback controller is obtained by solving a Linear Quadratic Regulator problem for the linearized Bounssinesq equations. Applying classical results for semilinear equations where the linear term generates an analytic semigroup, we establish that this Riccati-based optimal boundary feedback control provides a local stabilizing controller for the full nonlinear Boussinesq equations. In addition, we present a finite element Galerkin approximations and discuss convergence issues. Finally, we provide numerical results based on standard Taylor-Hood elements to illustrate the theory.