Matrix Computations & Scientific Computing Seminar

Organizer: James Demmel & Ming Gu

Wednesday, 11:00AM–12:00Noon, 380 Soda

Sept. 18 **Shiv Chandrasekaran**, UC Santa Barbara

A Minimum Sobolev Norm technique for the numerical solution of elliptic PDEs

Recently there has been interest in using first-order formulations of elliptic PDEs for numerical purposes (FOLS, Strain, Tuomela, etc.). The main advantage would be a common solver for a wide variety of PDEs and this in turn might ease the numerical handling of nonlinear PDEs. However, first-order elliptic PDEs have their own theoretical (Krupchyk, Tuomela, et. al.) and numerical issues (Strain). In this talk we present a method for the numerical solution of elliptic PDEs based on finding solutions that minimize a certain Sobolev norm. Fairly standard compactness arguments establish convergence. The method prefers that the PDE is presented in first order form. A single short Octave code is used to solve problems that range from first-order Maxwell's equations, to Oseen's, to elasticity, to fourth-order bi-harmonic problems in R^2. The method seems to be high-order convergent even on complex curved geometries. We will try to point out how our approach deals with the "non-squareness" of the first-order set-up. Our method is dependent on some recent advances in high relative accuracy algorithms in numerical linear algebra. We will discuss still open issues.