Numerical Analysis and Scientific Computing Seminar

Algebraic Preconditioning of Symmetric Indefinite Systems

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Abstract: Sparse symmetric indefinite linear systems of equations arise in many practical applications. An iterative method is frequently the method of choice to solve such systems but a system transformation called preconditioning is often required for the solver to be effective. In the talk we will deal with development of incomplete factorization algorithms that can be used to compute high quality preconditioners. We will consider both general indefinite systems and saddle-point problems. Our approach is based on the recently adopted limited memory approach (based on the work of Tismenetsky, 1991) that generalizes recent work on incomplete Cholesky factorization preconditioners. A number of new ideas are proposed with the goal of improving the stability, robustness and efficiency of the resulting preconditioner. For general indefinite systems, these include the monitoring of stability as the factorization proceeds and the use of pivot modifications when potential instability is observed. Numerical experiments involving test problems arising from a range of real-world applications are used to demonstrate the effectiveness of our approach and comparisons are made with a state-of-the-art sparse direct solver.
The talk will be based on joint work with Jennifer Scott, Rutherford Appleton Laboratory.

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