APPLIED MATHEMATICS COLLOQUIUM

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Toward the Scalable Inversion of Structured Matrices with Standard Admissibility Conditions

Abstract: Hierarchically low-rank ("H-matrix") techniques are well-known to provide quasi-optimal solution techniques for the inversion of second-order elliptic equations with L-infinity coefficients and a dominant principal symbol, but the large problem sizes needed for their asymptotics to overtake their large coefficients have significantly slowed their adoption, for example, as a replacement for (algebraic) multigrid when handling pathological coefficients.

It is then natural to attempt to experimentally compare said techniques over very large-scale distributed-memory machines, but one immediately runs into the problem that structured direct factorization and inversion techniques are almost entirely sequential when separation is required for the interaction of two subdomains to be numerically low-rank (e.g., for Green's functions of multidimensional Poisson equations). Furthermore, executing Newton's method for matrix inversion in the approximate arithmetic is known to lead to poor approximations of the interior iterates, and so convergence is easily lost.

This talk discusses the retroactively obvious, but seemingly unexplored, idea of initializing Newton's method for the inversion of an H-matrix with a "standard" low-rank admissibility condition with an approximate inverse computed via a parallelizable direct inversion process which treats neighboring, disjoint subdomains as having a low-rank interaction.

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4:30 PM
Room E17-122

Applied Math Colloquium: http://www-math.mit.edu/amc/fall14/
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