Numerical Analysis and Scientific Computing Seminar

Modern Krylov Subspace Methods (and applications to Parabolic Control Problems)

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Abstract: In many circumstances, a known good preconditioner is not easily computable. Instead, an approximation to it is available. This is the case, for example, when the preconditioner has an inverse associated with it, such as in Schur complements (e.g., in saddle point problems), or in the reduced Hessian in some control problems. The application of the preconditioner implies then an iterative solution of a linear system. In these cases, the question is: how accurately to solve the (inner) iteration? In our work on Inexact Krylov methods, we have shown that the inner iterations can be solved progressively less accurately, as the underlying Krylov method (e.g., GMRES) converges to the overall solution. Computable inner stopping criteria were developed to guarantee convergence of the overall method. We discuss these criteria, and illustrate its application to several problems. In particular, we apply these ideas to parabolic control problems, where the reduced Hessian contains two different inverses, and thus two inner iteration criteria are needed. Truncated methods are also discussed.

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