TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

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Properties of Progressive GMRES and Flexible Conjugate Gradient

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Abstract.

We study Beckermann and Reichel's Progressive GMRES (ProGMRES) algorithm, a minimum residual method which approximates solutions to a linear system $Ax = b$ where $A \in \mathbb{C}^{n \times n}$ is nearly symmetric. We show that when A is symmetric, and possibly indefinite, the algorithm produces approximations equivalent in exact arithmetic to those produced by MINRES, an established iterative method for symmetric, indefinite linear systems. Numerical experiments imply that ProGMRES is computationally equivalent to MINRES for symmetric, possibly indefinite, matrices. However, in some experiments, ProGMRES appears to be less stable than MINRES. We also study Notay's Flexible Conjugate Gradient (FCG), described as an efficient truncated method for solving certain preconditioned systems. We then demonstrate via numerical experiment that this algorithm returns different approximations than either the truncated Full Orthogonalization Method (FOM) in the non-symmetric case or Conjugate Gradient in the symmetric case.