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*On adaptive control strategy for restarting GMRES*

The Generalized Minimal Residual method (GMRES) is normally used for the solution of large, sparse and nonsymmetric linear systems arising from science and engineering problems. In practice, the restarted GMRES method, denoted as GMRES( $m$ ), is used to reduced storage and orthogonalization costs. However, if an inappropriate  $m$  is chosen, the method may present stagnation or slow convergence.

This talk has two parts. In the first part, we discuss advances in the control theory for accelerating the convergence of GMRES( $m$ ). This new method modifies adaptively the dimension of the Krylov subspace using control techniques. In the second part, we discuss techniques used to overcome stagnation in GMRES( $m$ ). The techniques are based on the modification of the structure of the search subspace. In particular, we discuss conditions for characterizing the stagnation of the restarted GMRES method, and we show several alternatives to avoid such stagnation using adaptive control for switching conveniently the enrichment between several possible options obtained from the literature. Results of our implemented techniques, solving problems with real data, are presented and show that the adaptive method is more robust than classical ones.

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