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Approximate inverse preconditioning and Gram-Schmidt orthogonalization

Date, Time, Room to be filled in later by organizers

One of the most important and frequently used preconditioning techniques for solving symmetric positive definite systems is based on computing the approximate inverse factorizations. It is also a well-known fact that such factors can be computed column by the orthogonalization process applied to the unit basis vectors provided that we use a non-standard inner product induced by the positive definite system matrix A. In this contribution we consider the classical Gram-Schmidt algorithm (CGS), the modified Gram-Schmidt algorithm (MGS) and also yet another variant of sequential orthogonalization, which is motivated originally by the AINV preconditioner and which uses oblique projections. The orthogonality between computed vectors is crucial for the quality of the preconditioner constructed in the approximate inverse factorization. While for the case of the standard inner product there exists a complete rounding error analysis for all main orthogonalization schemes, the numerical properties of the schemes with a non-standard inner product are much less understood. We will formulate results on the loss of orthogonality and on the factorization error for all previously mentioned orthogonalization schemes.
This contribution is joint work with Jiří Kopal (Technical University Liberec), Miroslav Tůma a nd Alicja Smoktunowicz (Warsaw University of Technology).

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