Error estimation and evaluation of matrix functions

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Abstract

The need to evaluate expressions of the form $f(A)$ or $f(A)b$, where f is a nonlinear function, A is a large sparse matrix, and b is a vector, arises in many applications. We discuss how the Faber transform applied to the field of values of A can be used to determine error bounds for popular polynomial and rational approximation methods based on the Arnoldi and rational Arnoldi processes. The situation when A is symmetric and the rational function has a preselected pole receives particular attention. In this case orthogonal bases of rational Krylov subspaces can be determined with short recursion relations. The talk presents joint work with B. Beckermann and C. Jagels.