Computing Approximate Extended Krylov Subspaces without Explicit Inversion

Thomas Mach, Miroslav Pranić, and Raf Vandebril

Thomas Mach
Department of Computer Science
KU Leuven, Belgium
Thomas.Mach@cs.kuleuven.be

Miroslav Pranić
Department Mathematics and
Informatics
University of Banja Luka, Bosnia and
Herzegovina
pranic77m@yahoo.com

Raf Vandebril
Department of Computer Science
KU Leuven, Belgium
Raf.Vandebril@cs.kuleuven.be

Abstract

It has been shown that approximate extended Krylov subspaces can be computed –under certain assumptions– without any explicit inversion or system solves. Instead the vectors spanning the extended Krylov space are retrieved in an implicit way, via unitary similarity transformations, from an enlarged Krylov subspace. In this paper this approach is generalized to rational Krylov subspaces, which contain besides poles at infinity and zero, also finite non-zero poles. Furthermore, the algorithms are generalized to deal with block rational Krylov subspaces and techniques to exploit the symmetry when working with Hermitian matrices are also presented.

For each variant of the algorithm numerical experiments illustrate the power of the new approach, the experiments involve matrix functions, Ritz-value computations, and the solutions of matrix equations.

KU LEUVEN

www.kuleuven.be