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A REFINED UNSYMMETRIC LANCZOS EIGENSOLVER FOR COMPUTING ACCURATE EIGENTRIPLETS OF A REAL UNSYMMETRIC MATRIX*

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Dedicated to Gene Golub on the occasion of his 75th birthday

Abstract. For most unsymmetric matrices it is difficult to compute many accurate eigenvalues using the primitive form of the unsymmetric Lanczos algorithm (ULA). In this paper we propose a modification of the ULA. It is related to ideas used in [J. Chem. Phys. 122 (2005), 244107 (11 pages)] to compute resonance lifetimes. Using the refined ULA we suggest, the calculation of accurate extremal and interior eigenvalues is feasible. The refinement is simple: approximate right and left eigenvectors computed using the ULA are used to form a small projected matrix whose eigenvalues and eigenvectors are easily computed. There is no re-biorthogonalization of the Lanczos vectors and no need to store large numbers of vectors in memory. The method can therefore be used to compute eigenvalues of very large matrices. The idea is tested on several matrices.

Key words. Eigenproblem, unsymmetric matrices, Lanczos algorithm

AMS subject classifications. 15A18, 65F15, 65F50

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