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CONVERGENCE THEORY FOR INEXACT INVERSE ITERATION APPLIED TO THE GENERALISED NONSYMMETRIC EIGENPROBLEM*

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

Abstract. In this paper we consider the computation of a finite eigenvalue and corresponding right eigenvector of a large sparse generalised eigenproblem $\mathbf{A}\mathbf{x} = \lambda\mathbf{M}\mathbf{x}$ using inexact inverse iteration. Our convergence theory is quite general and requires few assumptions on $\mathbf{A}$ and $\mathbf{M}$. In particular, there is no need for $\mathbf{M}$ to be symmetric positive definite or even nonsingular. The theory includes both fixed and variable shift strategies, and the bounds obtained are improvements on those currently in the literature. In addition, the analysis developed here is used to provide a convergence theory for a version of inexact simplified Jacobi-Davidson. Several numerical examples are presented to illustrate the theory: including applications in nuclear reactor stability, with $\mathbf{M}$ singular and nonsymmetric, the linearised Navier-Stokes equations and the bounded finline dielectric waveguide.

Key words. Inexact inverse iteration, nonsymmetric generalised eigenproblem

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