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Accelerating the Induced Dimension Reduction method using spectral information

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Abstract

The Induced Dimension Reduction method (IDR(s)) [*SIAM J. Sci. Comput.*, 31(2) (2008), pp. 1035–1062] is a short-recurrences Krylov method to solve systems of linear equations. In this work, we accelerate this method using spectral information. We construct a Hessenberg relation from the IDR(s) residual recurrences formulas, from which we approximate the eigenvalues and eigenvectors. Using the Ritz values, we propose a self-contained variant of the Ritz-IDR(s) method [*SIAM J. Sci. Comput.*, 32(4) (2010), pp. 1898–1912] for solving a system of linear equations. In addition, the Ritz vectors are used to speed-up IDR(s) for the solution of sequence of systems of linear equations.

Keywords: Induced Dimension Reduction method, system of linear equations, sequence of systems of linear equation, eigenvalues and eigenvectors.

1. Introduction

In this work, we are interested in accelerating the convergence of the Induced Dimension Reduction method (IDR(s)) [1] to solve a system of linear equations

$$A\mathbf{x} = \mathbf{b}, \qquad \text{with } A \in \mathbb{C}^{n\times n} \text{ and } \mathbf{b} \in \mathbb{C}^n, \tag{1}$$

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