Accepted Manuscript

On local quadratic convergence of inexact simplified Jacobi-Davidson method for interior eigenpairs of Hermitian eigenproblems

Zhong-Zhi Bai, Cun-Qiang Miao

PII: S0893-9659(17)30101-5
DOI: http://dx.doi.org/10.1016/j.aml.2017.03.021
Reference: AML 5219

To appear in: *Applied Mathematics Letters*

Received date : 17 February 2017
Revised date : 30 March 2017
Accepted date : 30 March 2017

Please cite this article as: Z. Bai, C. Miao, On local quadratic convergence of inexact simplified Jacobi-Davidson method for interior eigenpairs of Hermitian eigenproblems, Appl. Math. Lett. (2017), http://dx.doi.org/10.1016/j.aml.2017.03.021

On Local Quadratic Convergence of Inexact Simplified Jacobi-Davidson Method for Interior Eigenpairs of Hermitian Eigenproblems *

Zhong-Zhi Bai[‡ §] and Cun-Qiang Miao[‡ §]

[‡]*State Key Laboratory of Scientific/Engineering Computing*
Institute of Computational Mathematics and Scientific/Engineering Computing
Academy of Mathematics and Systems Science
Chinese Academy of Sciences, P.O. Box 2719, Beijing 100190, P.R. China
Emails: bzz@lsec.cc.ac.cn, miaocunqiang@lsec.cc.ac.cn

[§]*School of Mathematical Sciences*
University of Chinese Academy of Sciences
Beijing 100049, P.R. China

Abstract

For the Hermitian eigenproblems, under proper assumption on an initial approximation to the desired eigenvector, we prove local quadratic convergence of the inexact simplified Jacobi-Davidson method when the involved relaxed correction equation is solved by a standard Krylov subspace iteration, which particularly leads to local cubic convergence when the relaxed correction equation is solved to a prescribed precision proportional to the norm of the current residual. These results are valid for the interior as well as the extreme eigenpairs of the Hermitian eigenproblem and, hence, generalize the results by Bai and Miao in 2017 (Linear Algebra Appl. 520(2017), 215-241) from the extreme eigenpairs to the interior ones.

Keywords: Hermitian eigenproblem, Jacobi-Davidson method, inexact iteration, standard Krylov subspace iteration, local convergence.

AMS(MOS) Subject Classifications: 65F10, 65F15, 15A18; CR: G1.3.

1 Introduction

Consider the standard matrix eigenvalue problem

$$Ax = \lambda x, \quad \text{with} \quad \|x\| = 1, \tag{1.1}$$

where $A \in \mathbb{C}^{n\times n}$ is a large sparse Hermitian matrix, $\lambda \in \mathbb{C}$ is an eigenvalue of the matrix A, and $x \in \mathbb{C}^n$ is the associated (right) eigenvector. Here we denote by $\|\cdot\|$ the Euclidean norm

*Supported by The National Natural Science Foundation (No. 11671393) and The National Natural Science Foundation for Creative Research Groups (No. 11321061), P.R. China.