A hybrid of the restarted Arnoldi and electromagnetism meta-heuristic methods for calculating eigenvalues and eigenvectors of a non-symmetric matrix

S.H. Taheri a,b,*, H. Ghazvini c,d, J. Saberi-Nadjafi a, J. Biazar d

a Department of Mathematics, School of Mathematical Science, Ferdowsi University of Mashhad, P.O. Box 1159, P.C. 91775 Mashhad, Iran
b Department of Mathematics, Faculty of Science, Khayyam University, Iran
c Department of Mathematics, School of Mathematical Science, Shahrood University of Technology, P.O. Box 316, P.C. 3619995161 Shahrood, Iran
d Department of Mathematics, Faculty of Sciences, Guilan University, P.O. Box 1914, P.C. 41938 Rasht, Iran

Abstract

In this paper, we present a new algorithm, which is called electromagnetism meta-heuristic restarted Arnoldi algorithm (EM-RA) for calculating eigenvalues and eigenvectors of a non-symmetric matrix. In most of the restarting methods the basic idea is a selection of the best initial eigenvector, but our aim is to improve the initial eigenvectors in each iteration of the restarting method. Numerical examples are used to show the good numerical properties.

Keywords: Eigenvalue; Eigenvector; Electromagnetism meta-heuristic method; Restarted Arnoldi method; Non-symmetric matrix

1. Introduction

One of the most important and interesting topics in the numerical linear algebra is calculating the eigenvalues of a large non-symmetric matrix. The applications of eigenvalues in sciences and engineering make the topic more noticeable. We are interested in computing a few eigenvalues and eigenvectors of a large non-symmetric matrix. There are several methods for this purpose, among the methods the Arnoldi method is very important and this algorithm is a method of Krylov subspace. In this method, the idea is to make the matrix similar to Hessenberg form. However, the resulting eigenvalues is not correct and needs to be improved. The aim of this paper is to combine the restated Arnoldi method with electromagnetism meta-heuristic method (EM) and to try to overcome local convergence with high accuracy.

* Corresponding author. Address: Department of Mathematics, School of Mathematical Science, Ferdowsi University of Mashhad, P.O. Box 1159, P.C. 91775 Mashhad, Iran.
E-mail addresses: ha_taheri@stu-mail.um.ac.ir (S.H. Taheri), hghazvini@guilan.ac.ir (H. Ghazvini), nadjafi@math.um.ac.ir (J. Saberi-Nadjafi), biazar@guilan.ac.ir, jbiazar@dal.ca (J. Biazar).

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