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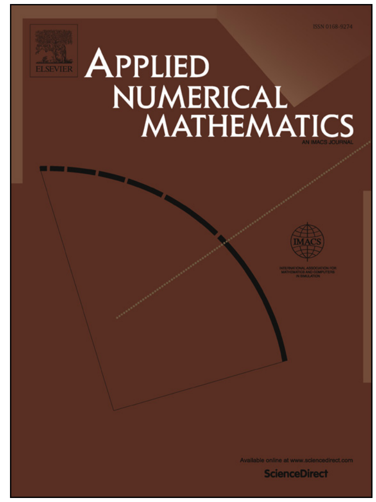

Comparison results for splitting iterations for solving multi-linear systems

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Comparison Results for Splitting Iterations for Solving Multi-linear Systems

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Abstract

It is known that the spectral radius of the iterative tensor can be seen as an approximate convergence rate for solving multi-linear systems by tensor splitting iterative methods. So in this paper, first we give some spectral radius comparisons between two different iterative tensors. Then, we propose the preconditioned tensor splitting method for solving multi-linear systems, which provides an alternative algorithm with the choice of a preconditioner. In particular, also we give some spectral radius comparisons between the preconditioned iterative tensor and the original one. Numerical examples are given to demonstrate the efficiency of the proposed preconditioned methods.

Keywords. Comparison theorem, tensor splitting, spectral radius, multi-linear systems, preconditioned methods.

MSC 15A48 15A69 65F10 65H10

1 Introduction

Recently, because of some applications, the following multi-linear system:

$$\mathcal{A}\mathbf{x}^{m-1} = \mathbf{b}, \tag{1.1}$$

has attracted more and more attention (e.g., see [4],[12],[14],[23]), where $\mathcal{A} = (a_{ii_2\cdots i_m})$ is an order m dimension n tensor, $\mathbf{b}$ is an n dimensional vector, and the tensor-vector product $\mathcal{A}\mathbf{x}^{m-1}$ is defined by

$$(\mathcal{A}\mathbf{x}^{m-1})_i = \sum_{i_2,\cdots,i_m=1}^{n} a_{ii_2\cdots i_m} x_{i_2} \cdots x_{i_m}, \quad i = 1, 2, ..., n, \tag{1.2}$$

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