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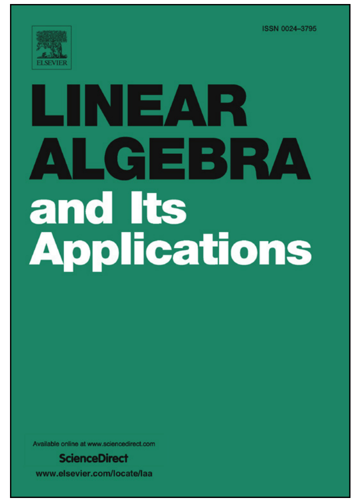

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Brauer-type eigenvalue inclusion sets of stochastic/irreducible tensors and positive definiteness of tensors

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Abstract

In this paper, Brauer-type eigenvalue inclusion sets of stochastic tensors and irreducible tensors are given, respectively. Some sufficient conditions of positive (semi-)definiteness of stochastic tensors are obtained. Furthermore, the stability of a high-order nonlinear system is analysed by positive definiteness of tensors.

Keywords: Tensor, Stochastic tensor, Eigenvalue of tensor, Inclusion set, Positive definiteness, Stability of nonlinear system
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1. Introduction

Let $[n] = \{1, 2, \ldots, n\}$ and $\mathbb{C}^{[m,n]}$ (resp. $\mathbb{R}^{[m,n]}$) denote the set of order m dimension n tensors over complex field $\mathbb{C}$ (resp. real field $\mathbb{R}$). A tensor $\mathcal{A}$ is called *symmetric* if all the entries of $\mathcal{A}$ are invariant under any permutation of their indices.

In 2005, Qi [27] and Lim [24] proposed the concept of eigenvalue of tensors, respectively. Let $\mathcal{A} = (a_{i_1 i_2 \cdots i_m}) \in \mathbb{C}^{[m,n]}$, if there exist $\lambda \in \mathbb{C}$ and a nonzero vector $x = (x_1, \ldots, x_n)^{\mathrm{T}} \in \mathbb{C}^n$ such that

$$\mathcal{A}x^{m-1} = \lambda x^{[m-1]}, \tag{1.1}$$

then λ is called an *eigenvalue* of $\mathcal{A}$ and x is called an *eigenvector* of $\mathcal{A}$ corresponding

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