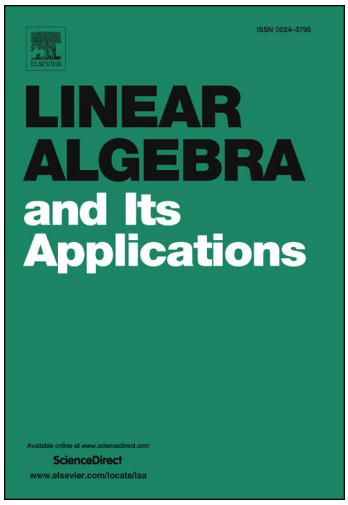

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PII: S0024-3795(17)30027-7
DOI: http://dx.doi.org/10.1016/j.laa.2017.01.011
Reference: LAA 14012

To appear in: *Linear Algebra and its Applications*

Received date: 6 September 2016
Accepted date: 12 January 2017

Please cite this article in press as: D. Hu et al., The spectral distribution of random mixed graphs, *Linear Algebra Appl.* (2017), http://dx.doi.org/10.1016/j.laa.2017.01.011

The spectral distribution of random mixed graphs*

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Abstract

Let G be a mixed graph with n vertices, $H(G)$ the Hermitian adjacency matrix of G, and $\lambda_1(G), \lambda_2(G), \ldots, \lambda_n(G)$ the eigenvalues of $H(G)$. The Hermitian energy of G is defined as $\mathcal{E}_H(G) = \sum_{i=1}^{n} |\lambda_i(G)|$. In this paper we characterize the limiting spectral distribution of the Hermitian adjacency matrices of random mixed graphs, and as an application, we give an estimation of the Hermitian energy for almost all mixed graphs.

Keywords: Random mixed graphs; Empirical spectral distribution; Limiting spectral distribution; Hermitian energy

Mathematics Subject Classification: 05C50, 15A18.

1 Introduction

Let $\{M_n\}_{n=1}^{\infty}$ be a sequence of $n \times n$ random Hermitian matrices. Suppose that $\lambda_1(M_n)$, $\lambda_2(M_n), \ldots, \lambda_n(M_n)$ are the eigenvalues of M_n. The *empirical spectral distribution* (ESD) of M_n is defined by

$$F^{M_n}(x) = \frac{1}{n}\#\{\lambda_i(M_n) | \lambda_i(M_n) \leq x, i = 1, 2, \ldots, n\},$$

where $\#\{\cdot\}$ is the cardinality of the set. The distribution to which the ESD of M_n converges as $n \to \infty$ is called the *limiting spectral distribution* (LSD) of $\{M_n\}_{n=1}^{\infty}$.

*Supported by NSFC (No. 11271300, 11571135, 11671320 and 11601431) and "973" program (No. 2013CB834204)

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