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Anu Varghese, Wasin So, A. Vijayakumar

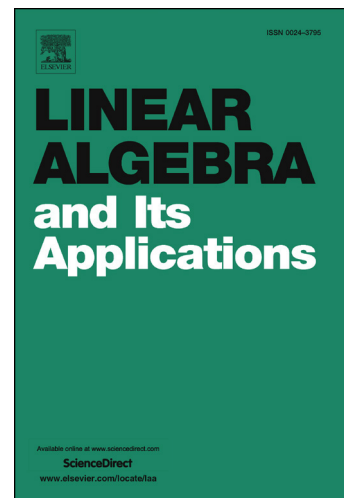
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Distance Energy Change of Complete Bipartite Graph Due to Edge Deletion

Anu Varghese¹

Department of Mathematics, Bishop Chulaparambil Memorial College, Kottayam, India.

Wasin So

Department of Mathematics and Statistics, San Jose State University, San Jose, CA 95192, USA.

A. Vijayakumar

Department of Mathematics, Cochin University of Science and Technology, Cochin, India.

Abstract

The distance matrix, distance eigenvalue, and distance energy of a connected graph have been studied intensively in the literature. We propose a new problem of studying how the distance energy changes when an edge is deleted. In this paper, we prove that the distance energy of a complete bipartite graph is always increased when an edge is deleted.

Keywords: Distance matrix, Distance eigenvalue, Distance energy, Distance energy change, Edge deletion.

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1. Introduction

Let G be a connected graph of order $n \geq 1$ with vertex set $\{v_1, v_2, \dots, v_n\}$. The distance matrix of G is the $n \times n$ matrix $D(G) = [d_{ij}]$, where d_{ij} is the distance between the vertices v_i and v_j . The eigenvalues $\{\lambda_1, \dots, \lambda_n\}$ of $D(G)$ are called the distance eigenvalues of G , and they are all real because $D(G)$ is a real symmetric matrix. The distance energy of G is defined by

$$E_D(G) = \sum_{i=1}^n |\lambda_i|.$$

Since $D(G)$ has zero diagonal entries, $\lambda_1 + \dots + \lambda_n = \text{tr}(D(G)) = 0$. Hence

$$E_D(G) = 2 \sum_{\lambda_i > 0} \lambda_i = -2 \sum_{\lambda_i < 0} \lambda_i$$

¹Present Address: Anu Varghese, Department of Mathematics, Cochin University of Science and Technology, Cochin, India.

Email addresses: anukarintholil@gmail.com (Anu Varghese), wasin.so@sjsu.edu (Wasin So), vambat@gmail.com (A. Vijayakumar)

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