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Seidel Laplacian Energy of Fuzzy graphs

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Abstract

The energy of a graph is related to its spectrum, which is equal to the total of the latent values of the pertinent adjacency matrix. In this research work, we proposed some of the features and the energy of the Seidel Laplacian of a fuzzy graph. Also, the lower and upper bounds for the energy of the Seidel Laplacian of a fuzzy graph were studied with suitable illustrative examples.

Keywords: Graph, Energy of a graph, Seidel Laplacian energy, Fuzzy set, Fuzzy graph

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1. Introduction

Many difficulties in daily life are solved using graph theory. For instance, Euler resolved the infamous "Konigsberg bridges" problem in 1735. Although it is the first platform to employ concepts from graph theory, it is difficult to glean precise information about it due to the system's size and complexity [1]. Fuzzy graphs are used in such systems to solve them.

Zadeh proposed fuzzy sets in 1965, whose concept is only a membership function. Based on his fuzzy relationship, *Kaufman* suggested the fuzzy graph in 1973. Fuzzy sets were used in real-life problems with uncertainty. Fuzzy logic can be used in many applications, like tracking the maximum power from solar power voltaic and controller circuit design applications [2–5].

Later, *Rosenfeld* elaborated on the definition of graph theory, which includes fuzzy vertices and fuzzy edges. One of the most current research areas in what has become a promising multidisciplinary field is fuzzy graph theory. Graph theory depicts a group of items and their relationships through pictures or diagrams. There are numerous applications for graph theory in different categories, such as Mathematics, Information technology, Computer science, Chemistry, Modelling, Networking, Physics and Biology to mention a few.

Now a days, a greater number of works are involved in some particular topics like labelling, indices, and hubset [6–8]. *Akalyadevi* et al. defined the Spherical neutrosophic cubic fuzzy models in a bipolar environment and studied their operations [9–12]. The pair of sets (V, E) that represent the formal definition of a graph are V, which is the set of nodes, and E, which is the set of edges linking the vertices. *Ivan Gutman* initiated the energy concept in 1978. The energy of the graph is calculated using the eigen (latent) values of the relevant adjacency matrix. A graph's overall absolute value of its latent values as determined by its adjacency matrix. *Mcclellaud* also investigated the graph's energy boundaries, for which he developed the Mcclellaud inequality. For fuzzy graphs, *Sunil Mathew* et al. defined the adjacency matrix and energy. Also, some conclusions concerning the energy bounds for weighted and simple graphs are enhanced.

Fuzziness is added to energy calculations to increase their resilience, adaptability, and