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Energy of a semigraph

Gaidhani Y.S.[a,*], Deshpande C.M.[b], Pirzada S.[c]

[a] *M.E.S. Abasaheb Garware College, Pune, India*
[b] *College of Engineering, Pune, India*
[c] *Kashmir University, Shrinagar, India*

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Abstract

Semigraph is a generalization of graph. We introduce the concept of energy in a semigraph in two ways, one, the matrix energy E_m, as summation of singular values of the adjacency matrix of a semigraph, and the other, polynomial energy E_{re}, as energy of the characteristic polynomial of the adjacency matrix. We obtain some bounds for E_m and show that E_m is never a square root of an odd integer and E_{re} cannot be an odd integer. We investigate matrix energy of a partial semigraph and change in the matrix energy due to edge deletion.

Keywords: Semigraph; Matrix energy of a semigraph; Polynomial energy of a semigraph; Edge induced complete semigraph; Edge induced complete closure

1. Introduction

Let G be a graph of order n and let A be the adjacency matrix of G. The eigenvalues $\lambda_1, \lambda_2, \ldots, \lambda_n$ of A are called eigenvalues of G. The energy of a graph is defined as the sum of the absolute values of its eigenvalues [1] and it is an extensively studied quantity [2,3]. There are two generalizations of graph energy. Nikiforov [4] generalized the concept of graph energy to that of the energy of any matrix. He defined the energy of a matrix M as the sum of the singular values of M. Another generalization of the graph energy is due to Mateljevic [5] who defined the energy of arbitrary polynomial such that Coulson integration formula remains valid.

Sampathkumar [6] generalized the definition of a graph to a semigraph in the following way.

Definition 1. A *semigraph* G is an ordered pair of two sets V and X, where V is a non-empty set whose elements are called vertices of G and X is a set of n-tuples, called edges of G, of distinct vertices, for various n (n at least 2) satisfying the following conditions:

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* Corresponding author.
E-mail addresses: [illegible] (Gaidhani Y.S.), [illegible] (Deshpande C.M.), [illegible] (Pirzada S.).

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