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Energy of a Graph

Let G be a graph on n vertices. Let $\lambda_1, \lambda_2, \dots, \lambda_n$ be its eigenvalues (i.e., the eigenvalues of the adjacency matrix of G). The energy of G is defined as [1]

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

The name “energy” was chosen because in certain (limited) cases $E(G)$ is related to the energy of certain molecules. Some fundamental and some newest results on $E(G)$ [2] will be presented, and some open problems indicated.

The quantity

$$EE(G) = \sum_{i=1}^n e^{\lambda_i}$$

was recently proposed as a measure of “centrality” of complex networks [3]. Some properties of $EE(G)$ will also be discussed, in particular its relation to $E(G)$.

References

- [1] I. Gutman, *The energy of a graph*. Ber. Math.-Statist. Sect. Forsch. Graz **103**(1978), 1–22.
- [2] *The energy of a graph: Old and new results*. Algebraic Combinatorics and Applications, Springer, Berlin, 2001, 196–211; *Spectra and energies of iterated line graphs of regular graphs*. Appl. Math. Lett. **18**(2005), 679–682; *Laplacian energy of a graph*. Lin. Algebra Appl. **414**(2006), 29–37; *Note on the Coulson integral formula*. J. Math. Chem. **39**(2006), 259–266.
- [3] E. Estrada and J. A. Rodríguez-Velázquez, *Subgraph centrality in complex networks*. Phys. Rev. **E71**(2005), 056103.