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Graph Eigenvalues and Energies

Abstract for the Combinatorics Seminar 2010 October 26

A symmetric matrix associated with a graph has real eigenvalues. The corresponding *energy* is the sum of magnitudes of the eigenvalues. The original idea, from chemistry, was the energy associated with the adjacency matrix A(G), but recently two new matrices of a graph and their eigenvalues and energies have become popular; they are the “Laplacian” matrix (previously known as the Kirchhoff or admittance matrix) D(G) - A(G) and the “signless Laplacian” D(G) + A(G), where D is the diagonal matrix of vertex degrees. Both “Laplacians” are Kirchhoff matrices of signed graphs, +G for the former and -G for the latter. I will show how to calculate eigenvalues and energies of the adjacency and Kirchhoff matrices in some examples, both particular graphs (paths, circles, and complete graphs) and constructions like the Cartesian product and the line graphs.
