Graphs and Their Matrices

Thesis Abstract

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Abstract

  The main goal of this thesis is to use algebraic methods and matrix theory to solve problems of graph theory. As our focus, we considered our application which is "effective resistance in electrical networks". In recent years, it has been extensively studied in mathematics and physics.

  This led us to study the basic concepts of matrix theory and fundamental of graph theory such as connected graph, directed graph, undirected graph, degree of vertex, walk, path, cycle and tree with their properties. Furthermore, we also studied incidence matrix, adjacency matrix, Laplacian matrix and their interrelation, eigenvalues and rank. Finally, we explored various methods to determine the effective resistance. For example, we may compute it via the Moore-Penrose generalized inverse of Laplacian matrix of graph or probability of random walk on graphs.