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Spectral Properties of Cycle Digraph

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ABSTRACT

Spectral graph theory, a specialized branch of graph theory, extensively studies the spectral properties of matrices associated with graphs, particularly the adjacency matrix. These spectral properties typically include the characteristic polynomial, eigenvalues, and eigenvectors of a graph. This research determines the spectral properties of cycle digraph, which is a type of directed graph. To preserve the directionality of the cycle digraph, Hermitian adjacency matrix has been applied on the cycle digraph to represent the structure of cycle digraph. The research provides a generalization of the spectral properties of cycle digraph with finite vertices through lemmas, theorems, and corollaries. The results include an explicit formula for the characteristic polynomial and generalized patterns of eigenvalues. Furthermore, other spectral properties such as algebraic multiplicity and the pairwise negative relationships of eigenvalues are established. Finally, a significant pattern in the eigenvectors corresponding to the eigenvalues is determined. These findings provide the groundwork for further exploration in the spectral analysis of directed graphs.

Keywords: *Spectral Graph Theory; Cycle Digraph; Hermitian Adjacency Matrix; Eigenvalues; Eigenvectors*