

ABSTRACT

A Matrix Approach To Matching Polynomials

Shanaz Ansari Wahid

This thesis deals with a new approach to the evaluating of a graph polynomial called the matching polynomial.

Let G be a graph. By a matching we mean a spanning subgraph whose components are nodes and edges only. With every node and edge of G , let us associate weights w_1 and w_2 respectively. With every matching in G having k edges, let us associate the monomial $w_1^{p-2k}w_2^k$, where p is the number of nodes in G . Then the matching polynomial of G is

$$M(G; w_1, w_2) = \sum a_k w_1^{p-2k} w_2^k,$$

where a_k is the number of matchings with k edges and the summation is taken over all matchings in G .

This polynomial gives a wealth of information about the subgraphs of G . It also has many applications in the physical sciences.

Analytical properties of $M(G, \mathbf{w})$ such as its partial derivatives are investigated and combinatorial interpretations of the results of these operations are given. Several classes of graphs having the same matching polynomial are identified.

This new matrix approach for finding $M(G, \mathbf{w})$ has led to several new and interesting results. Among these are the reconstruction of

the matching polynomial of a graph from the matching polynomials of its subgraphs and the construction of a graph from its matching polynomial. The idea of a D-graph is central to this matrix approach. New methods are given for calculating the Rook Polynomial and Chromatic Polynomial. The D-graph and the newly defined pseudo matching polynomial are efficient tools for deriving matching polynomials of cactus type graphs.