ABSTRACT

This thesis deals with a graph polynomial called the matching polynomial.

Let G be a graph. With every node and edge of G let us associate weights w_1 and w_2 respectively. With every matching in G with k edges, let us associate the monoid $w_1^{p-2k} w_2^{k}$, where p is the number of nodes in G. Then the matching polynomial of G is

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

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 matchings in G. The matching polynomial has many applications in the physical sciences.

Analytical properties of $M(G; \underline{w})$ such as integration and partial differentiation are investigated and combinatorial interpretations of these operations are given.

Several classes of graphs having the same matching polynomial are identified and in many cases, methods are given for enlargement of these graphs.

General recurrences are derived for various types of 1-dimensional lattices. Also explicit results are derived for the numbers of various kinds of matchings.

Finally, a matrix approach is used to derive the general recurrences previously obtained.