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Coefficient Matrices

If we are working with characteristic polynomials of graphs and X is a graph on n vertices, its *coefficient matrix* if the $n \times n$ matrix whose i-th row is the vector of coefficients of the characteristic polynomial $\phi(x \setminus i, t)$ of the i-th vertex-deleted subgraph of X.

There is an analog based on matching polynomials. Let $p(X, k)$ denote the number of matchings of X. The *matching polynomial* of X is

$$\mu(X,t) = \sum_{k \geq 0} (-1)^{n-2k} p(X,k) t^{n-2k}.$$

Matching polynomials share many of the properties of characteristic polynomials—for example their zeros are real, and the matching polynomial of a forest is equal to its characteristic polynomial. In the context of matching polynomials, the *coefficient matrix* has the coefficients of the polynomials $\mu(X \setminus i, t)$ as its rows.

My talk will introduce these matrices. I will present an application of the characteristic coefficient matrix to a graph invariant arising from continuous quantum walks, and an application of the matching coefficient matrix to the construction of pairs of non-isomorphic graphs with the same matching polynomial.