Cohen-Macaulay Coloring Complexes

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Abstract

A coloring complex is a relative simplicial complex that arise in combinatorics. The first example is the coloring complex of a graph: the chromatic polynomial of a graph is the Hilbert polynomial of the corresponding coloring complex. Hence, information about the coloring complex implies information about chromatic polynomials. However, there are coloring complexes for posets and matroids as well. Our motivation is to find new inequalities for the coefficients of such polynomials. Recently, Sanyal has found new conditions on Hilbert polynomials of relative Cohen-Macaulay complexes.

We are interested in studying minor-closed families of colorings complexes (such as all coloring complexes coming from graphs, posets, or matroids). Our goal is to determine necessary and sufficient *combinatorial* conditions for determining when *all* coloring complexes in a minor-closed family are Cohen-Macaulay. We will report on our partial progress in this area.