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Betti Numbers and H-polynomials

The Poincaré polynomial of a Weyl group calculates the Betti numbers of G/B. The h-vector of a rational, simplicial polytope calculates the Betti numbers of a corresponding toric variety. There is a common generalization of these two extremes called the *H-polynomial*. It applies to projective, homogeneous spaces, toric varieties and, much more generally, any algebraic variety X where there is a connected, solvable, algebraic group acting with a finite number of orbits. We illustrate the situation by calculating some H-polynomials related to generalized "rook" monoids.