

Poincaré-Betti Series of Monomial Rings

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Abstract

Let $I \subseteq \mathbf{k}[x_1, \dots, x_n] = R$ be an ideal. The Poincaré-Betti series of quotient ring $S = R/I$ is a formal power series of the form $P_{R/I}(t) = \sum_i \dim_{\mathbf{k}} \operatorname{Tor}_i^{R/I}(\mathbf{k}, \mathbf{k}) t^i$. Finding a complete characterization of what ideals $I \subseteq R$ give rise to rational power series is still an open question, although certain classes of ideals (monomial, toric, and complete intersections) have been studied extensively. Similarly, giving formulas for minimal free resolutions of \mathbf{k} over S remains open in most cases. In this talk, we examine several open (and approachable) problems in constructing such resolutions, and look at combinatorial approaches in the two and three variable cases.

Keywords: Polynomial ring, ideal, quotient ring, free resolution.