Queen's Algebraic Geometry
— Seminar —

THE NAKAYAMA FUNCTOR ON MONOMIAL IDEALS

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Abstract

For a multiindex $\mathbf{a}$ in $\mathbb{N}^n$, E. Miller defined the notion of $\mathbf{a}$-determined monomial ideal, meaning that every minimal generator of the ideal divides $\boldsymbol{x}^{\mathbf{a}}$. One may even define a category of $\mathbf{a}$-determined modules over the polynomial ring S in n variables. On this category (or rather its derived category) one has two dualities, the duality $\mathrm{Hom}_S\big(-, S(-\mathbf{a})\big)$, and Alexander duality. The composition of these is the Nakayama functor. This functor turns out to have finite order on these categories, in particular for square free modules it has order three. We compute the multigraded homology spaces and Betti spaces of the iterates of this functor. These turn out to be given by reduced homology goups of various associated simplicial complexes. A very special case of this are the formulas of Hochster for the multigraded parts of the local cohomology modules and Betti spaces of a simplicial complex.

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