ZERO-DIMENSIONAL GORENSTEIN IDEALS

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Let $p(x_1, \ldots, x_r)$ be a polynomial in r variables whose terms have the same total degree, and let $s \geq 1$ be an integer. This project concerns the *colon* ideal $I = \langle x_1^s, \ldots, x_r^s \rangle : p$, that is, the collection of all polynomials $f(x_1, \ldots, x_r)$ such that $f \cdot p$ can be written as a linear combination $h_1 x_1^s + \cdots + h_r \cdot x_r^s$. We provide a partial characterization of those polynomials p for which I requires more generators than the number of variables r; we call this collection $C_{(r,s)}$. We characterize two infinite families of polynomials that must belong to $C_{(3,s)}$. In addition, we describe explicitly another family of polynomials which do not lie in $C_{(3,s)}$. Finally, we give experimental evidence supporting various conjectures about the polynomials in $C_{(2,s)}$, $C_{(3,s)}$ and $C_{(4,s)}$.