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Nebraska, Lincoln, NE 68588-0130. *Comparing Powers and Symbolic Powers of Ideals.*

We develop tools to study the problem of containment of symbolic powers $I^{(m)}$ in powers I^r for a homogeneous ideal $I \subset k[\mathbf{P}^N]$ in a polynomial ring $k[\mathbf{P}^N]$ in $N + 1$ variables over an arbitrary algebraically closed field k . We obtain results on the structure of the set of pairs (r, m) such that $I^{(m)} \subset I^r$. As corollaries, we show that I^2 contains $I^{(3)}$ whenever S is a finite generic set of points in \mathbf{P}^2 and we show that the containment theorems of Ein-Lazarsfeld-Smith and Hochster-Huneke are optimal for every fixed dimension and codimension. (Received September 13, 2007)