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COMPARING THE REGULARITY AND h-POLYNOMIAL OF IDEALS

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Let I be a homogeneous ideal in a polynomial ring R. The Castelnuovo-Mumford regularity of the quotient ring, denoted $\operatorname{reg}(R/I)$, is an important invariant of the ring that is a rough measure of the computational complexity of the ring. On the other hand, because I is homogenous, we can define the Hilbert series of R/I, which can be written in the form $\frac{h(t)}{(1-t)^e}$. The polynomial $h(t)$ is the h-polynomial of R/I. Hibi and Matsuda initiated an investigation into the possible values of (r, d), where $r = \operatorname{reg}(R/I)$ and $d = \deg h(t)$. They showed that for any $(r, d) \in \mathbb{N}^2$, there is a monomial ideal I with regularity r and $\deg h(t) = d$. In this talk we survey the main results that compare these two invariants, with a focus on ideals that are defined combinatorially.