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Wednesday, November 18, 2009
12:45 PM
127 Hayes-Healy Center

Title: Formulas for the multiplicity of graded algebras

Abstract:

This is a continuation of the previous talk. For simplicity, we will assume that A is contained in B , a homogeneous inclusion of standard graded Noetherian domains over a field. We want to express the multiplicity of A in terms of that of B and local multiplicities along the projective spectrum of B . One of the applications is to find the multiplicity of the special fibre ring of an ideal generated by forms of the same degree in a standard graded Noetherian algebra over a field.

Observe that the dimension of A is always less than or equal to that of B . They are equal if and only if their quotient fields extension is algebraic of degree r . If B is integral over A , i.e. the dimension of B/A_1B is zero, then $e(B) = re(A)$. In 2001, Simis, Ulrich and Vasconcelos gave a formula when both rings have the same dimension and the dimension of B/A_1B is equal to one. We generalize their formula to arbitrary dimensions of B/A_1B . We also provide the formula for the case when the dimension of A is strictly less than the dimension of B . Thus we give a complete answer to the original question. The techniques we use are j -multiplicities and filter-regular sequences.

The formulas we obtain can be used to find the degree of dual varieties for any hypersurfaces without any restrictions on its dual varieties and singularities. In particular, it gives a generalization of Teissier's Plücker formula to hypersurfaces with non-isolated singularities.