

SOUTHEAST COMMUTATIVE ALGEBRA MEETING

ALL SESSIONS ARE HELD IN 204 MAP

Saturday 23 January 2010.

9:00am: **Refreshments**

9:30-10:30am: **Tai Huy Ha**, *Asymptotic linearity of regularity and a*-invariant of powers of an ideal.*

Let $X = \text{Proj } R$ and let I be a homogeneous ideal in R . It is known that the regularity of I^q is asymptotically a linear function $aq + b$ (for q large). The linear constant a is well understood from reduction theory. Recently, Eisenbud and Harris showed that when I is generated by general forms of the same degree, the free constant b can be related to a set of local data associated to a linear projection of X defined by the generators of I . In this talk, we shall discuss the situation when I is generated by arbitrary forms of the same degree.

11:00-12:00: **Hema Srinivasan**, *Gorenstein determinantal ideals.*

We study the determinantal ideals that are Gorenstein and their resolutions. We will describe explicitly the resolution of height four Gorenstein determinantal ideals and some extensions and questions arising from them.

12:00-2:00pm **Lunch break**

2:00-3:00pm: **Seth Sullivant**, *Combinatorial symbolic powers*

Symbolic powers are studied in the combinatorial context of monomial ideals. When the ideals are generated by quadratic squarefree monomials, the generators of the symbolic powers are obstructions to vertex covering in the associated graph and its blowups. As a result, perfect graphs play an important role in the theory, dual to the role played by perfect graphs in the theory of secants of monomial ideals. We use Gröbner degenerations as a tool to reduce questions about symbolic powers of arbitrary ideals to the monomial case. Among the applications are a new, unified approach to the Gröbner bases of symbolic powers of determinantal and Pfaffian ideals.

3:15-4:15pm: **Sean Sather-Wagstaff**, *Extension and Torsion Functors for Artinian Modules.*

Let R be a commutative noetherian ring. It is well known that if N and N' are noetherian R -modules, then the modules $\text{Ext}_R^i(N, N')$ and $\text{Tor}_i^R(N, N')$ are also noetherian. Similarly, if N is a noetherian R -module and A is an artinian R -module, then the modules $\text{Ext}_R^i(N, A)$ and $\text{Tor}_i^R(N, A)$ are artinian. We will discuss the properties of Ext and Tor modules when applied to other combinations of noetherian modules, artinian modules, and Matlis reflexive modules. This is joint work with Bethany Kubik (NDSU) and Micah Leamer (UNL).

4:30-5:30pm: **Claudia Miller**, *Hilbert-Kunz multiplicities in characteristic zero*.

This talk concerns the question of whether a simpler limit can be used to obtain the limit Hilbert-Kunz multiplicity, a possible candidate for a characteristic zero Hilbert-Kunz multiplicity. I will first introduce this multiplicity, give some of its history, and finally discuss an affirmative answer for one of the main cases for which it is known to exist, namely that of the affine cones of smooth projective curves. The proof involves more careful estimates of bounds found independently by Brenner and Trivedi on the dimensions of the cohomologies of twists of certain syzygy bundles as the characteristic p goes to infinity and uses asymptotic results of Trivedi on the slopes of Harder-Narasimham filtrations of Frobenius pullbacks of bundles. This is joint work with Holger Brenner and Jinjia Li.

Sunday 24 January 2010.

9:00am: **Refreshments**

9:30-10:30: **Steven Dale Cutkosky**, *Semigroups of valuations*.

Let (R, m_R) be a local domain, with quotient field K . Suppose that ν is a valuation of the K with valuation ring (V, m_V) , and that ν dominates R ; that is $R \subset V$ and $m_V \cap R = m_R$. The possible value groups Γ of ν have been extensively studied and classified; Γ can be an ordered abelian group of finite rational rank. The ring V is Noetherian if and only if $\Gamma \cong \mathbb{Z}$. The semigroup

$$S^R(\nu) = \{\nu(f) \mid f \in m_R - \{0\}\}$$

is however not well understood, although it is known to encode important information about the topology and resolution of singularities of $\text{Spec}(R)$.

In this talk, we discuss what is known about this problem, and recent progress by the author, including joint work with Bernard Teissier, and with Kia Dalili and Olga Kascheyeva.

11:00-12:00 **Hans Schoutens**, *Uniform bounds for Betti numbers of CM modules*.

The n -th Betti number of a module M over a Noetherian local ring R is the rank of the n -th syzygy in a minimal resolution of M . I will show that there is a bound on the Betti number only depending on n , on the dimension of R , and on the multiplicity of R and M , whenever R and M are CM. To mention only one application, if two maximal CM modules are close (in a sense to be made precise), then they have the same Betti number. The proof uses cataproducts, which are a generalization of direct limits using some tools from model-theory.