JORNADAS DE ÁLGEBRA,
GEOMETRÍA ALGEBRAICA Y SINGULARIDADES

AULA 9, FACULTAD DE MATEMÁTICAS, UNIVERSIDAD DE LA LAGUNA

Lunes, 10 de Junio de 2013

09:30-09:45	Presentación
09:45-10:45	Bernard Teissier
10:45-11:15	Café
11:15-12:15	Carlos Galindo
12:15-13:00	Irene Márquez
13:00-13:45	Ignacio García
13:45-17:00	Almuerzo
17:00-19:00	Sesiones de trabajo

Martes, 11 de Junio de 2013

09:00-10:00	Alberto Vigneron
10:00-10:45	Eva García
10:45-11:15	Café
11:15-12:15	Alejandro Melle
12:15-13:00	Ana Belén de Felipe

Organiza el Grupo de Investigación GASIULL (Universidad de La Laguna).

Comité Científico: Félix Delgado (Universidad de Valladolid) y Bernard Teissier (CNRS, París)

Comité Organizador: Roland Barrolleta, Ana Belén de Felipe y Evelia García (Universidad de La Laguna)

Colaboran el Vicerrectorado de Investigación y Transferencia de Conocimiento, la Facultad de Matemáticas y el Área de Álgebra de la Universidad de La Laguna.

Conferencias invitadas

Multiplier ideals and log-canonical threshold for complete ideals of 2-dimensional local regular rings

Galindo, C. (Universidad Jaume I)

In the talk, we will study multiplier ideals and log-canonical threshold for a complete ideal I of a 2-dimensional regular local ring R over the complex field. Multiplier ideals are a recent and important tool in Singularity Theory and Birational Geometry. They have the virtue of giving information on the type of singularity corresponding to an ideal, divisor or metric and of accomplishing several vanishing theorems which makes them very useful. The family of multiplier ideals is totally ordered by inclusion and parameterized by a set of non-negative rational numbers named jumping numbers.

Firstly, we will consider the case when I is simple, we will recall which are its jumping numbers (computed by Järvilheto) and we will introduce the Poincaré series of multiplier ideals of I. This is an algebraic object that gathers in an unified way the jumping numbers and the dimensions of the vector spaces determined by the quotients of consecutive multiplier ideals of I. An explicit and very simple formula for this series will be given. The second part will be devoted to the non-simple case, we will show an explicit formula for computing the least jumping number, called log canonical threshold, of I. This formula will be deduced from other one we will give for reduced germs of plane curves. This last formula works for any field and depends on the first two maximal contact values of the branches and their intersection multiplicities.

The results in the talk have been obtained jointly with F. Monserrat and, in the log canonical threshold case, also with F. Hernando.

Power structure over the Grothendieck ring of complex quasi-projective varieties and its applications

Melle, A. (Universidad Complutense de Madrid)

A *power structure* over a ring R is a method to give sense to an expression of the form $(1+a_1t+a_2t^2+\ldots)^m$ where a_i and m belong to the ring so that all the usual properties of the exponential function hold. The authors introduced a natural power structure over the Grothendieck ring $K_0(V_C)$ of complex quasi-projective varieties. A special property of this power structure which is important for applications is its *effectiveness*. This means that if all the coefficients a_i of the series $A(T)$ and the exponent m are represented by classes of quasi-projective varieties (i.e. $a_i = [Ai]$ and $m = [M]$), then all the coefficients of the series $A(T)^m$ are represented by classes of quasi-projective varieties too, not by classes of virtual varieties. It can be used both for writing a number of statements in a short form and for proving new ones. For example one can give some formulae for the generating series of classes of Hilbert schemes of zero-dimensional subschemes in the plane invariant with respect to a cyclic group action. Also some properties of the (natural) power structure over the Grothendieck ring of stacks will be discussed. This is a joint work with Sabir M. Gusein-Zade and Ignacio Luengo.

On Abhyankar valuations

Teissier, B. (CNRS, París)

After a brief introduction on valuations I will survey some of what is known of Abhyankar valuations and their position in valuation spaces.

Algunos aspectos computacionales de los semigrupos descomponibles

Vigneron-Tenorio, A. (Universidad de Cádiz)

Mejorar el cálculo de los ideales de semigrupos es un problema muy tratado dentro del Álgebra Computacional. En particular, introduciremos los semigrupos descomponibles estudiando algunas de sus propiedades, dando además un sencillo algoritmo para determinar la descomposición de un semigrupo descomponible que permite hacer más rápida la computación de algunos objetos relacionados con ellos. Desde un punto de vista práctico, mostraremos diversos ejemplos basados en semigrupos procedentes de modelos estadísticos.

Literatura

[1] J.I. García-García, M.A. Moreno-Frías, A. Vigneron-Tenorio. *On the decomposable semigroups and applications.* To appear in Journal of Symbolic Computation.

Comunicaciones

Espacios de valoraciones

de Felipe, A. (Universidad de La Laguna)

Dados K un cuerpo y R un subanillo de K, dotaremos el conjunto de los anillos de valoración de K que contienen a R de diferentes topologías y presentaremos algunas propiedades del espacio obtenido en cada caso. Nos interesaremos por la situación particular en que K es el cuerpo de funciones de una variedad algebraica sobre un cuerpo R.

Regularidad de Castelnuovo-Mumford de curvas monomiales proyectivas asociadas a sucesiones aritméticas

García Llorente, E. (Universidad de La Laguna)

Dados k un cuerpo algebraicamente cerrado y $m_0, \ldots, m_n$ una sucesión aritmética tal que $\gcd\{\mathrm{m}_0, \ldots, \mathrm{m}_\mathrm{n}\} = 1$, consideramos la curva monomial proyectiva $\mathcal{C}$ definida por

$$x_0 = t^{m_0} s^{m_n - m_0}, \ldots, x_{n-1} = t^{m_{n-1}} s^{m_n - m_{n-1}}, x_n = t^{m_n}, x_{n+1} = s^{m_n}.$$

El objetivo de la charla es presentar una fórmula para la regularidad de Castelnuovo-Mumford de $\mathcal{C}$, $reg\,(\mathcal{C})$, en términos de la sucesión aritmética, que nos conducirá a un algoritmo eficiente para calcular $reg\,(\mathcal{C})$. Además, como consecuencia de nuestros resultados, veremos que $\mathcal{C}$ es aritméticamente Cohen-Macaulay.

Este trabajo ha sido realizado en colaboración con Isabel Bermejo.

Intersecciones completas en variedades tóricas simpliciales

García-Marco, I. (Universidad de La Laguna)

Dados k un cuerpo y $\mathcal{A} = \{a_1, \ldots, a_n\}$ un conjunto de vectores no nulos de $\mathbb{N}^m$ que determina un ideal tórico simplicial $I_{\mathcal{A}}$ de $k[x_1, \ldots, x_n]$, el objetivo de esta charla es presentar un algoritmo para decidir, a partir de $\mathcal{A}$, si el ideal tórico $I_{\mathcal{A}}$ es una intersección completa. Se continúa así con la línea de investigación iniciada en [1]. Cuando el ideal tórico es homogéneo, el algoritmo es más simple y lo utilizamos para listar las variedades tóricas simpliciales proyectivas de $\mathbb{P}_k^{n-1}$ que son intersección completa idealista y tienen, o bien un único punto singular, o son lisas. Todos los resultados que vamos a presentar se encuentran en [2]. El algoritmo obtenido ha sido implementado en ANSI C y en Singular, dando lugar a la librería `cisimplicial.lib` que se distribuye con el programa (ver [3]). Este trabajo ha sido realizado en colaboración con Isabel Bermejo.

Literatura

[1] Bermejo, I.; García-Marco, I.; Salazar-González, J. J. An algorithm for checking whether the toric ideal of an affine monomial curve is a complete intersection *J. Symbolic Computation* **42** (2007) 971–991.
[2] Bermejo, I.; García-Marco, I. Complete intersections in simplicial toric varieties arXiv:1302.6706.
[3] Bermejo, I.; García-Marco, I. `cisimplicial.lib` A distributed Singular 3-1-6 library for determining whether a simplicial toric ideal is a complete intersection (2012).

A semigroup approach to Complete Decoding linear and modular codes

Márquez-Corbella, I. (Universidad de Valladolid)

Complete decoding has many applications not only in Coding Theory but also in other areas of Information Security:

- The goal of Coding Theory is to efficiently transfer reliable information. One of the main applications of complete decoding process is that it describes the set of codewords of minimal support which it is an NP-problem since it is related with the problem that concerns this talk (complete decoding).
- Cryptography, is the science of secure communication in such a way that if a message is intercepted, it is not understood. In particular this research has applications in secret sharing schemes which is a cryptographic protocol for distributing a secret amongst a group of participants, such that only specified subsets are able to determine the secret from joining the shares they hold.
- Steganography is the science of stealth communication in such a way that no one, apart from the sender and the receiver, can detect the existence of a message. Complete decoding plays an important role in this science.

The purpose of this talk is to show how some error-correcting codes can be understood by means of appropriate commutative semigroups with given generators.

This construction establishes a strong relation between codes and semigroups and constitutes a means to apply numerous techniques inspired by toric mathematics from semigroups to problems in information theory.

We will study different representations for the semigroup S associated with modular and linear codes. However the choice of digital representations seems to be the best adapted to perform complete decoding on the selected codes. We understand by digital representation any generating set $\{\mathbf{n}_1, \ldots, \mathbf{n}_r\}$ of S such that every element $\mathbf{m} \in S$ can be written as

$$\sum_{i=1}^{r} a_i \mathbf{n}_i \text{ with } a_1, \ldots, a_r \in \{0, 1\} \subseteq \mathbb{N}.$$

The advantage of using digital representations lies on the equivalence between the degree of the monomials $\mathbf{X}^\gamma \in I(S)$ and the Hamming weight of the vectors γ.

Moreover the result of this talk could be generalized to other classes of codes such as codes defined over multiple alphabets or additive codes.

Grupos de trabajo

Grupo 1: Valoraciones

Grupo 2: Delta sucesiones generalizadas asociadas a valoraciones: aplicaciones a códigos de evaluación

Grupo 3: Códigos y álgebra computacional