Special Session 7: Holomorphic and Algebraic Foliations

Organizers: Carlos Galindo Pastor (Universidat Jaume I, Castellón, Spain) and Jorge Vitório Pereira (IMPA, Brazil).

What holomorphic singularities of foliations are realized by algebraic foliations?
Gabriel Calsamiglia

Universidade Federal Fluminense, Brazil

Thursday 25, 08:45-09:20

I will discuss the problem of deciding when a germ of holomorphic foliation on a complex surface occurs - up to a local change of coordinates - as germ of foliation of the projective plane, or, more generally, of some algebraic foliation of a projective surface.

Reduction of Singularities of Singular Holomorphic Foliations
Felipe Cano

Universidad de Valladolid, Spain

Friday 26, 08:45-09:20

We give the know results in the global and local uniformization cases. We also give a conjecture about the expected global statement. Some applications as the Local Brunella Conjecture will be presented.

Planar polynomial differential systems, algebraic limit cycles and plane Cremona maps
Antoni Ferragut

Universitat Jaume I, Castellón, Spain

Thursday 25, 09:25-10:00

Dynamical systems have evolved in the latter years. We see many solved problems and new techniques, and there is a large literature about the subject. However, there are some stalled problems that have remained at the same point for many years. It seems that we need new and fresh techniques, or different points of view, to go further.

In this talk we present some tools coming from the Algebraic Geometry, specially the Cremona transformations, that are allowing us to evolve a little bit more in some specific problems. Concretely, we show how we can transform accurately quadratic systems into new quadratic systems after some kind of birational transformations, the quadratic plane Cremona maps. We apply afterwards these transformations to the families of quadratic differential systems having an algebraic limit cycle. As a consequence, we provide a new family of quadratic systems having an algebraic limit cycle of degree 5. Moreover we show how the known families of quadratic differential systems having an algebraic limit cycle of degree greater than four are obtained using these transformations.

Furthermore, the use of plane Cremona maps allow us to obtain new examples of families having specific and new features, such as 90 (new) cubic differential systems having algebraic limit cycles of degrees from 2 to 10 and a cubic differential system, not Liouville integrable, having an invariant algebraic curve of degree 22.

This talk is the result of joint work with Maria Alberich-Carramiñana (UPC) and Jaume Llibre (UAB).

Foliations and webs with continuous symmetries on complex projective surfaces
David Marín

Universitat Autònoma de Barcelona, Spain

Thursday 25, 10:45-11:25

We will describe the structure of foliations and webs on complex projective surfaces which are invariant by a germ of birational flow.

We will discuss in detail the case of the projective plane, characterizing planar projective webs with many infinitesimal symmetries. This is a joint work with Marcel Nicolau.

A class of planar vector fields with polynomial first integral

Francisco Monserrat

Universidad Politécnica de Valencia, Spain

Thursday 25, 10:10-10:45

The talk is based on joint work with A. Ferragut and C. Galindo. We give an algorithm for deciding whether a planar polynomial differential system has a first integral which factorizes as a product of defining polynomials of curves with only one place at infinity. In the affirmative case, our algorithm computes a minimal first integral. In addition, we solve the Poincaré problem for the class of systems which admit a polynomial first integral as above in the sense that the degree of the minimal first integral can be computed from the reduction of singularities of the corresponding vector field.

Foliations by curves uniquely determined by minimal subschemes of its singularities

Jorge Olivares

CIMAT, Guanajuato, Mexico

Friday 26, 09:25-10:00

Let $\mathbb{P}^n = \mathbb{P}^n_{\mathbf{K}}$ be the projective space of dimension $n \geq 2$ over an algebraically closed ground field $\mathbf{K}$, let $\Theta_{\mathbb{P}^n}$ be its tangent sheaf and let

$$\mathbf{E} = \mathbf{E}(n, r-1) = \mathrm{H}^0(\mathbb{P}^n, \Theta_{\mathbb{P}^n}(r-1)).$$

A *foliation* (by curves, with singularities) of degree r in $\mathbb{P}^n$ is the class $[s] \in \mathbb{P}\mathbf{E}$ of a global section $s \in \mathbf{E}$.

The singular scheme $([s])_0$ of $[s]$ is the scheme of zeroes of $[s]$. We say that $[s]$ has isolated singularities if $\dim([s])_0 = 0$.

It is well-known that a foliation with isolated singularities $[s]$ of degree $r \geq 2$ in $\mathbb{P}^n$ is uniquely determined by its singular scheme $([s])_0$.

In the talk, we will show that the set of foliations which are uniquely determined by a subscheme (of *minimal* degree) of its singular scheme, contains a non-empty Zariski-open subset.

This is a joint work with Antonio Campillo (Valladolid).

Torus actions and singular foliations

Daniel Panazzolo

Université de Haute-Alsace, France

Friday 26, 10:50-11:25

We will show that torus actions appear naturally in several problems related to the local theory of singular foliations, such as normal form theory, invariant

varieties and resolution of singularities.

Foliations and Mori theory
Calum Spicer
Imperial College, London, UK

Friday 26, 10:10-10:45

In the case of varieties, the development of Mori theory has given a flexible and powerful framework to study both the global birational geometry of varieties, as well as the local geometry of singularities. I will explain some aspects of the application of the ideas of Mori theory to foliations, in particular indicating some recent work on corank 1 foliations on threefolds and time permitting show how these ideas can be used to understand both the global and local geometry of foliations.