

Abstracts

Arnaud Bodin

INTERMEDIATE LINKS OF PLANE CURVES.

For a smooth complex curve C , we consider the link $L(r)$ intersection of C with the boundary of $B(r)$, where $B(r)$ denotes an Euclidean ball of radius $r > 0$. A lot is known when r is small or large enough. What happens for the other values of r ? We explore this intermediate case via a projection of the link and some positivity of the associated braid.

This is a joint work with Maciej Borodzik.

Vincent Cossart

A STRICTLY DECREASING INVARIANT FOR RESOLUTION OF SINGULARITIES IN DIMENSION TWO

Hironaka's characteristic polyhedron and graded rings associated to monomial valuations allow us to define invariants of singularities used for desingularization

- in dimension 2 with positive residual characteristic,
- in every dimension in the characteristic 0 case.

These beautiful objects should be studied more deeply.

Joint work with B. Schober.

Toshizumi Fukui

LIPSCHITZ PROPERTY OF NASH MAPS.

We discuss Lipschitz property of blow-Nash homeomorphism and related notions. One conclusion is that a blow-Nash homeomorphism has Lipschitz inverse if and only if it is Lipschitz and the inverse is blow-Nash. We are going to describe the proof as elementary as possible. Then we are going to discuss its generalization as far as we can.

This is the joint work with K. Kurdyka and A. Parusinski.

Kazumasa Inaba

TOPOLOGY OF MIXED HYPERSURFACES OF CYCLIC TYPE.

Let $f_{II}(z, \bar{z}) = z_1^{a_1+b_1} \bar{z}_1^{b_1} z_2 + \cdots + z_{n-1}^{a_{n-1}+b_{n-1}} \bar{z}_{n-1}^{b_{n-1}} z_n + z_n^{a_n+b_n} \bar{z}_n^{b_n} z_1$ be a simplicial polynomial of cyclic type and $g_{II}(z) = z_1^{a_1} z_2 + \cdots + z_{n-1}^{a_{n-1}} z_n + z_n^{a_n} z_1$ be the associated polynomial of f_{II} , where $a_j \geq 1$ and $b_j \geq 0$ for $j = 1, \dots, n$. Oka showed that the link of f_t and that of the associated polynomial of f_t in a small sphere are isotopic and their Milnor fibrations are isomorphic, where f_t is a mixed Brieskorn polynomial or a simplicial polynomial of bamboo type. He conjectured the assertion will be also true for the case f_{II} . The purpose of this talk is to give a positive answer to

this conjecture.

This is a joint work with Masayuki Kawashima (Okayama University of Science) and Mutsuo Oka (Tokyo University of Science).

Naohiko Kasuya

NON-KÄHLER COMPLEX STRUCTURES ON \mathbb{R}^4

We consider the following problem. Is there any non-Kähler complex structure on \mathbb{R}^{2n} ? When $n = 1$, the answer is clearly negative. On the other hand, if n is bigger than 2, there exist uncountably many such complex structures. It has been proven by Calabi and Eckmann as a simple application of the Calabi-Eckmann manifolds. In this talk, we construct uncountably many non-Kähler complex structure on \mathbb{R}^4 to give the affirmative answer to the case where $n = 2$. For the construction, it is important to understand the genus-one achiral Lefschetz fibration $S^4 \rightarrow S^2$ found by Yukio Matsumoto and Kenji Fukaya.

This is a joint work with Antonio Jose Di Scala (Politecnico di Torino) and Daniele Zuddas (KIAS).

János Kollár

CELESTIAL SURFACES

We discuss a project, started by Kummer and Darboux, to describe all surfaces that contain at least 2 circles through every point.

Wojciech Kucharz

CURVE-RATIONAL FUNCTIONS

Let W be a subset of the set of real points of a real algebraic variety X . We investigate which functions on W are the restrictions of rational functions on X . We introduce two new notions: curve-rational functions (*i.e.*, continuous rational on algebraic curves) and arc-rational functions (*i.e.*, continuous rational on arcs of algebraic curves). We prove that under mild assumptions the following classes of functions coincide: continuous hereditarily rational (introduced recently by J. Kollár), curve-rational and arc-rational. In particular, if W is semialgebraic and f is arc-rational, then f is continuous and semialgebraic. We also show that an arc-rational function defined on an open set is arc-analytic (*i.e.*, analytic on analytic arcs). Furthermore, we study rational functions on products of varieties. As an application we obtain a characterization of regular functions. Finally, we get analogous results in the framework of complex algebraic varieties.

Joint work with J. Kollár and K. Kurdyka.

Ann Lemahieu

ON THE MONODROMY CONJECTURE FOR NONDEGENERATE HYPERSURFACE SINGULARITIES.

The monodromy conjecture predicts a relationship between the poles of p -adic integrals associated to a complex polynomial f and the monodromies of the complex hypersurface defined by f . In this talk we will concentrate on the monodromy conjecture at the level of the topological zeta function for hypersurface singularities that are nondegenerate w.r.t. their Newton polyhedron. We explain some partial results in higher dimension and we give a proof of the monodromy conjecture for ‘0-convenient’ singularities in dimension four.

This is work in progress with Alexander Esterov (HSE, Moscow) and Kiyoshi Takeuchi (University of Tsukuba, Japan).

Ta Lê Loi

HÖLDER-LOJASIEWICZ INEQUALITIES FOR VOLUMES OF TAME OBJECTS.

Let $h : K \rightarrow \mathbb{R}^n$ be a continuous subanalytic map, where K is a compact subset of \mathbb{R}^m . Then the Hölder-Lojasiewicz inequality gives the following estimation:

$$\|h(x) - h(y)\| \leq C|x - y|^\alpha, \text{ for all } x, y \in K,$$

where C and α are positive numbers. When K is convex, we have the following similar inequality for the images of the segments under h :

$$\text{length}(h([x, y])) \leq C_1 \text{length}([x, y])^\alpha, \text{ for all } x, y \in K.$$

We are interested in the generalizations of the above estimation for the lengths or the k -dimensional volumes of families of curves or k -dimensional surfaces. In this talk, we present some inequalities to estimate the volumes of the images or pre-images of families of sets definable in o-minimal structures through definable maps, via the volumes of the families involved. Briefly, we get some uniform bounds for families which say that the considering volumes do not become too big in comparison with the volumes of the input sets.

Nhan Nguyen

TANGENT CONES AND C^1 REGULARITY OF DEFINABLE SETS.

Let $X \subset \mathbb{R}^n$ be a connected locally closed definable set in an o-minimal structure. We prove that the following three statements are equivalent: (i) X is a C^1 manifold, (ii) the tangent cone and the paratangent cone of X coincide at every point in X , (iii) for every $x \in X$, the tangent cone of X at the point x is a k -dimensional linear subspace of \mathbb{R}^n (k does not depend on x) varies continuously in x , and the density $\theta(X, x) < 3/2$.

Join work with K. Kurdyka and O. Le Gal.

Tomohiro Okuma

A CHARACTERIZATION OF RATIONAL SURFACE SINGULARITIES VIA CORE OF IDEALS.

We introduce the p_g -ideals in the local ring of normal surface singularities and show that these ideals have some nice properties similar to those of integrally closed ideals in rational singularities. Then we give an explicit description of the core, which is the intersection of all reductions, of p_g -ideals using cycles on a resolution of singularity. As an application, we prove that a normal surface singularity is rational if the core preserves the inclusion of integrally closed ideals in the local ring.

This is a joint work with Kei-ichi Watanabe (Nihon Univ.) and Ken-ichi Yoshida (Nihon Univ.).

Camille Plénat

TORIC EMBEDDED RESOLUTIONS OF SIMPLE SINGULARITIES VIA JET SCHEMES.

One of the aim of Nash' paper on the arcs spaces (1968) was to understand resolutions of singularities via the arcs living on the singular variety; in particular he wanted to give a one to one correspondence between families of arcs and essential exceptional divisors. J.Fernandez de Bobadilla and M.Pe Pereira (2011) have shown that such a bijective correspondence for abstract resolutions of singular surfaces. But the proof does not give a constructive way to get the resolution from the arcs space. With H.Mourtada, we construct an embedded toric resolution of simple singularities from their jets schemes. It is the result I will discuss in the talk.

Joint work with H. Mourtada.

Delphine Pol

FREE SINGULARITIES AND LOGARITHMIC FORMS.

In his fundamental paper on logarithmic differential forms, K.Saito introduces the notions of logarithmic vector fields, logarithmic differential forms and their residues along a hypersurface. When the module of logarithmic vector fields is free, we say that the hypersurface is free. More recently, A.G.Aleksandrov and A.Tsikh study a generalization of the notion of logarithmic forms to the complete intersection case, and then to Cohen-Macaulay spaces. A natural question which then arises is to generalize the notion of freeness to spaces of higher codimension. In this talk, we will first recall Saito's theory, and then we will focus on the complete intersection case. In particular, we will give several characterizations of freeness which extend the hypersurface case.

Armin Rainer

REGULAR ROOTS OF POLYNOMIALS AND ITS APPLICATIONS.

It is well-known that in general the roots of a polynomial

$$P_{a(x)}(Z) = Z^n + \sum_{j=1}^n a_j(x)z^{n-j},$$

whose coefficients are smooth functions $a_j : \mathbb{R}^m \rightarrow \mathbb{C}$, cannot be represented by smooth (even locally Lipschitz) functions. In recent work we proved that in the one dimensional case $m = 1$ the roots admit locally absolutely continuous representations, and we determined their optimal Sobolev regularity $W^{1,p}$. In several dimensions $m > 1$ the situation is more complicated, since there need not exist continuous choices of the roots due to monodromy phenomena, and hence the roots cannot be in any $W^{1,p}$, for $p \geq 1$.

In this talk I will review our work on optimal Sobolev regularity of the roots and present our results on representations of the roots by functions of bounded variation (BV). The space of BV-functions seems to be a natural habitat for the roots of polynomials depending smoothly on several parameters, since it allows for jump type discontinuities. I will also give several applications of our results.

Joint work with Adam Parusinski.

Matteo Ruggiero

NON-EXPANDING BEHAVIOR OF THE ANGULAR DISTANCE ON VALUATION SPACES.

We define a distance ρ on a suitable set of valuations centered at a normal surface singularity. We show that the action induced by dominant maps on the singularity is not expanding with respect to ρ . We deduce fixed point theorems for this action, and precise information about the existence of algebraically stable models for such maps.

Joint work with William Gignac.

Kyoji Saito

DE RHAM COHOMOLOGY GROUP FOR FLAT MORPHISM.

Consider a flat morphism between complex varieties. If it is proper, then it is well known that the hypercohomology group of the associated relative De Rham complex is coherent on the target space. For non-proper (open) map case, this is no-longer true in general. However, the cohomology groups are quite interesting and important to study vanishing cycles associated with the morphism. We prove the coherence under suitable boundary conditions on the morphism. As a by-product, we introduce Koszul-de Rham bi-dg-algebra, whose cohomologies seem to be of interest by themselves.

Takahiro Saito

ON THE MIXED HODGE STRUCTURES OF THE INTERSECTION COHOMOLOGY STALKS OF COMPLEX HYPERSURFACES.

We consider the intersection cohomology complex of a hypersurface in \mathbb{C}^n having isolated singularity at 0, and study the mixed Hodge structure of the stalk at 0 of the complex. We give a formula for the dimensions of graded pieces of the weight filtration of this mixed Hodge structure, in terms of the numbers of Jordan blocks of the Milnor monodromy of the defining polynomial. As an application of this result, we compute the dimensions of intersection cohomology groups $IH^i(X; \mathbb{C})$ of a projective hypersurface $X \subset \mathbb{C}\mathbb{P}^n$ with some isolated singularities.

Ichiro Shimada

CONNECTED COMPONENTS OF THE MODULI OF ELLIPTIC K3 SURFACES

The combinatorial type of an elliptic K3 surface with a zero section is the pair of the ADE -type of singular fibers and the torsion part of the Mordell-Weil group. We determine the set of connected components of the moduli of elliptic K3 surfaces with fixed combinatorial type. Our method relies on the theory of Miranda and Morrison on the structure of a genus of even indefinite lattices, and computer-aided calculations of p-adic quadratic forms.

Pho Duc Tai

ON THE CONVERSE TO BEZOUT'S THEOREM AND THE SINGULARITIES OF TORUS CURVES.

In this talk I will consider the converse to Bezout's theorem of plane curves as follows : "Given k positive integers s_1, s_2, \dots, s_k " such that $s_1 + s_2 + \dots + s_k = mn$. Then there exists two curves of degrees m and n that they intersect each other at k points with multiplicities s_1, s_2, \dots, s_k ". I will give partial answers for this problem and as an application I will explain the geometry of singularities on certain torus curves.

Asahi Tsuchida

THE THEORY OF GENERALIZED HAMILTONIAN SYSTEMS ALONG SUBMANIFOLDS AND ITS APPLICATIONS TO GEOMETRIC CONTROL THEORY AND SUB-RIEMANNIAN GEOMETRY.

The concept of generalized Hamiltonian systems is introduced by P.A.M. Dirac in 1950. One of directions to study the generalized Hamiltonian system is given by T. Fukuda and S. Janeczko; the smooth solvability of the system. In this talk, it is given that refinements and improvements of their result and application to study a kind of singularity of control systems and abnormal curves of sub-Riemannian submanifold.

Kazushi Ueda

THE CLASS OF THE AFFINE LINE IN THE GROTHENDIECK RING OF VARIETIES.

The Grothendieck ring of varieties is the quotient of the free abelian group generated by the set of isomorphism classes of algebraic varieties by the relation $[X \setminus Z] = [X] - [Z]$ for closed embeddings $Z \subset X$. In the talk, we discuss pairs (X, Y) of varieties such that $[X] - [Y]$ is annihilated by the class of the affine line.

This is a joint work with Atsushi Ito, Makoto Miura, and Shinnosuke Okawa.

Takahiro Yamamoto

ELIMINATION OF BOUNDARY SINGULARITIES OF STABLE MAPS OF MANIFOLDS WITH BOUNDARY INTO SURFACES.

It is well known that if N^n is a closed n -manifold ($n \geq 2$), then a stable map $f: N^n \rightarrow P^2$ into a surface P^2 has folds and cusps as its singularities. Furthermore, if N^n has boundary, then f has folds and cusps, boundary folds, boundary cusps and B_2 singularities as its singularities. In this talk, we study elimination of B_2 singularities of stable maps of compact manifolds with boundary by smooth homotopy.

Masahiko Yoshinaga

THE EULER CHARACTERISTIC RECIPROCITY FOR ORDER POLYNOMIALS.

It is well known that the Euler characteristic can be considered as a generalization of the notion of cardinality of finite sets. We will apply the above idea to the study of "combinatorial reciprocity", and formulate a reciprocity at the level of Euler characteristics. This talk is based on the joint work with Takahiro Hasebe. (<http://arxiv.org/abs/1601.00254>)

Zhenjian Wang

ON TANGENTIAL DEFORMATION OF HOMOGENEOUS POLYNOMIALS.

The Jacobian ideal provides the set of infinitesimally trivial deformations for a homogeneous polynomial, or for the corresponding projective hypersurface. In this talk, we investigate the extendability of an infinitesimally trivial deformation in a linear way, and show that the answer is no in a generic situation.