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ABSTRACTS

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CAPES

PROGRAMA DE PÓS-GRADUAÇÃO EM MATEMÁTICA
INSTITUTO DE CIÊNCIAS EXATAS - UFMG

APUBHUFMG+
SINDICATO DOS PROFESSORES

Geometry in Algebra
and
Algebra in Geometry VII

Schedule and Abstracts

October 23–27, 2023, Belo Horizonte, Brazil

List of Speakers

Alex Sierra Cardenas	—	UFPA, Brazil
André Contiero	—	UFMG, Brazil
Arturo Ulises Fernández Pérez	—	UFMG, Brazil
Carolina Araujo	—	IMPA, Brazil
Clarice Netto	—	IME-USP, Brazil
Csaba Schneider	—	UFMG, Brazil
Daniele Faenzi	—	Université de Bourgogne, France
Elizaveta Vishnyakova	—	UFMG, Brazil
John MacQuarrie	—	UFMG, Brazil
Marco Boggi	—	UFF, Brazil
María Amelia Salazar	—	UFF, Brazil
Matias del Hoyo	—	UFF, Brazil
Miquel Cueca Ten	—	University of Göttingen, Germany
Rosa Maria Miró-Roig	—	Universitat de Barcelona, Spain
Victor Pretti	—	IME-USP, Brazil

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ABSTRACTS

Mini-courses:

DANIELE FAENZI (UNIVERSITÉ DE BOURGOGNE, FRANCE).

Ulrich bundles

Ulrich modules and their sheaf-theoretic counterpart have been studied under several points of view, notably as Cohen-Macaulay modules having the maximal number of minimal generators, or as sheaves having extremal cohomological vanishing properties.

Their existence on an arbitrary closed subscheme of the projective space would have strong consequences for the study of Chow forms and for Boij-Söderberg's theory of the cone of Betti tables, which we will review. However, existence of Ulrich sheaves remains conjectural in general, as it is only established on some classes of varieties (curves, complete intersections, etc). The study of invariants and moduli spaces of Ulrich sheaves is largely uncharted territory, for instance we have no indication of what should be the minimal rank of an Ulrich sheaf on a given variety.

We will start by reviewing many of the basic properties of Ulrich sheaves, in connection with splitting of vector bundles, ACM sheaves and minimal resolutions of graded modules.

Then we will analyse some of the techniques connected to the construction and classification of Ulrich sheaves, especially for varieties of low dimension or codimension, such as determinantal representations of hypersurfaces, Serre's construction, deformation theory of simple and semistable sheaves.

We will also will discuss the equivariant setting in connection with representation theory and homogeneous bundles, positivity properties of Ulrich sheaves and material related to moduli spaces of cubic fourfolds.

Main references: [ESW03, Bea18, CMRPL21, Cos17].

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[CMRPL21] LAURA COSTA, ROSA MARÍA MIRÓ-ROIG, AND JOAN PONS-LLOPIS, *Ulrich bundles—from commutative algebra to algebraic geometry*, De Gruyter Studies in Mathematics, vol. 77, De Gruyter, Berlin, [2021] ©2021.

[Cos17] EMRE COSKUN, *A survey of Ulrich bundles*, Analytic and algebraic geometry, Hindustan Book Agency, New Delhi, 2017, pp. 85–106.

[ESW03] DAVID EISENBUD, FRANK-OLAF SCHREYER, AND JERZY WEYMAN, *Resultants and Chow forms via exterior syzygies*, J. Amer. Math. Soc. **16** (2003), no. 3, 537–579.

MIGUEL CUECA (GOTTINGEN UNIVERSITY)

The geometry of homological algebra

In this minicourse, I will give an introduction to graded manifolds. First I will define Q-manifolds and explain their relation to homological algebra. In particular, relevant geometric examples will be given. Then I will explore the symplectic Q-manifolds and their relevance in physics. If time permits the relation between Q-manifolds and Lie n-groupoids will be addressed.

Talks:

Alex Sierra Cardenas (UFPA, Brazil)

Some results about Brauer configurations induced by finite groups

Given a Brauer configuration algebra Λ associated to the Brauer configuration $\Gamma = (\Gamma_0, \Gamma_1, \mu, \mathfrak{o})$, it is possible to compute two important invariants of Λ: its Cartan matrix and the length of any of its indecomposable projective modules. These two invariants can be computed directly from the combinatorial information of Γ. Now, any finite group G induces a natural Brauer configuration that in turn induces a Brauer configuration algebra. Using the invariants mentioned above and the Brauer configuration algebra induced by the finite group G, we may demonstrate a numerical expression that relates the occurrences of all the elements of a subgroup H of G in any other subgroup to the orders of the subgroups obtained by intersecting H with all the subgroups of G. From this numerical relation it is also obtained an interesting expression for the particular case of cyclic finite groups.

André Contiero (UFMG, Brazil)

Vertex Operators on Exterior Algebras

The goal of this talk is to discuss the polynomial ring representations of the Lie algebra of endomorphisms of an exterior algebra, generalizing the bosonic vertex representation of DJKM. The main tool is the notion of Schubert derivation, introduced by Gatto in 2005.

Arturo Ulises Fernández Pérez (UFMG, Brazil)

On the Milnor number of a foliation

In this presentation, we introduce a definition for the Milnor number associated with non-isolated singularities of holomorphic foliations. Additionally, we discuss a result concerning the topological invariance of this number under specific conditions. This work is joint Gilcione Nonato Costa and Rudy Rosas.

CAROLINA ARAUJO (IMPA, BRAZIL)

Gale duality, blowups and moduli spaces

To understand the birational geometry of a projective variety X, one seeks to describe all rational contractions from X. From an algebraic perspective, information about all these contractions are encoded in the ring formed by all sections of all line bundles on X, the Cox ring of X. In this talk, we discuss the birational geometry and the Cox ring of blowups of projective spaces at points in general position. For that, we explore Gale duality, a correspondence between sets of $n = r + s + 2$ points in projective spaces $\mathbb{P}^s$ and $\mathbb{P}^r$. For small values of s, this duality has a remarkable geometric manifestation: the blowup of $\mathbb{P}^r$ at n points can be realized as a moduli space of vector bundles on the blowup of $\mathbb{P}^s$ at the Gale dual points.

CLARICE NETTO (IME-USP, BRAZIL)

Compatibility between Courant algebroids and Nijenhuis operators

We define Courant-Nijenhuis (CN) algebroids using the formalism of generalized derivations on vector bundles. From this approach, we introduce a definition of Dirac-Nijenhuis (DN) structures which recovers the Poisson-Nijenhuis structures when the Courant algebroid is the standard bundle $TM \oplus T^*M$. We explore the example of holomorphic Courant algebroids and apply this notion of CN algebroids to Kahler geometry. Moreover, we revisit the theory of Manin triples for Lie algebroids, and establish a relation between Lie-Nijenhuis bialgebroids, CN algebroids and DN structures.

CRISTIAN DANILO OLARTE (UDEA, COLOMBIA)

Differential forms in $C^\infty-$ringed spaces

C^∞-algebraic geometry, the differential analog of Grothendieck's algebraic geometry, was introduced in the 1960-s in the context of synthetic differential geometry and was recently developed by Dominic Joyce in his Derived Differential Geometry program. In this framework, rings are replaced by C^∞-rings, which are objects that generalize $\mathbb{R}$-algebras since they have not only the sum and product operations but one operation for every smooth function $f \in C^\infty(\mathbb{R}^n)$ and every $n \in \mathbb{N}$. Therefore, geometric objects such as ringed spaces have their C^∞ counterparts. In particular, we can define C^∞-schemes and C^∞-stacks which generalize several notions of differentiable spaces such as smooth manifolds and orbifolds.

In this presentation, we will address some facts about the construction of a complex of differential forms on a locally ringed C^∞-space. This construction, as in the case of manifolds, turns out to be functorial,therefore forms can be integrated over simplices and a version of Stoke's theorem holds.

CSABA SCHNEIDER (UFMG, BRAZIL)

The Algebra and Geometry of Lie Algebra Invariants with Computations in Mind

Invariants of Lie algebras play an important role in many areas of mathematics, such as algebra, geometry, and even in theoretical physics. In this talk, I will outline a practical procedure that can be turned into an algorithm for the calculation of algebraically independent generators of the field of rational invariants. The procedure is based on the method of characteristic curves and was implemented in the system SageMath. Treating this method as a purely algebraic procedure, we obtain several interesting results on the algebra of polynomial invariants and also on the field of rational invariants. This is joint work with Vanderlei Lopes de Jesus and Igor Martins Silva.

ELIZAVETA VISHNYAKOVA (UFMG, BRAZIL)

Graded covering in supergeometry

In geometry there is a well-known notion of a covering space. A classical example is the following universal covering: $p : \mathbb{R} \to S^1$, $t \mapsto \exp(it)$. Another example of this notion is a flat covering or torsion-free covering in the theory of modules over a ring. All these coverings satisfy some common universal properties. In the paper "Super Atiyah classes and obstructions to splitting of supermoduli space", Donagi and Witten suggested a construction of a first obstruction class for splitting a supermanifold. It appeared that an infinite prolongation of the Donagi-Witten construction satisfies universal properties of a covering. In other words this is a covering of a supermanifold in the category of graded manifolds.

Our talk is devoted to the notion of a covering in the super Lie theory and supergeometry.

JOEL TORRES DEL VALLE (UDEA, COLOMBIA)

Towards an abstract Riemann "super" surface over a superfield

In this talk we will present the progress we have made in our quest to construct a notion of a Riemman supersurface over a superfield. Specifically, we will address the notions of Dedekind superrings and valuations over superrings.

JOHN MACQUARRIE (UFMG, BRAZIL)

Block Theory of Profinite Groups

Block Theory for finite groups is an approach to the representation theory of finite groups: it starts from the simple observation that the group algebra can be written as a direct product of indecomposable algebras, and it's enough to study the modules for each factor separately. A profinite group is a (probably infinite) topological group that can be well-understood in terms of its finite quotients. Many facts about finite groups have "profinite analogues". In this talk, I'll explain these things and discuss the block theory of profinite groups, arriving at the observation that the finite/profinite analogy in block theory seems to be even stronger than usual! It's work from distinct projects with Ricardo Franquiz Flores (UFLA) and Peter Symonds (University of Manchester).

LUCAS HENRIQUE ROCHA DE SOUZA, (UFMG)

Sierpiński Carpets and relatively hyperbolic groups

The topology of a Bowditch boundary of a relatively hyperbolic group (with respect to a set of parabolic subgroups) has its importance, not only as an invariant for the group, but as a way to encode algebraic information about it, such as decompositions of the group as graphs of groups or if the group is a group of isometries of a manifold, for example. We present some examples of topological spaces that can appear as boundaries of relatively hyperbolic groups.

Whyburn showed that if we take a 2-sphere and remove an infinite collection of open disks satisfying some properties, then we get the 1-dimensional Sierpiński Carpet. After that, Cannon generalized it for n-dimensional Sierpiński Carpets. Recently, Tshishiku and Walsh gave another characterization of the Sierpiński Carpet: if we take a 2-sphere, remove a countable dense set and replace each point by a circle, then we get a 1-dimensional Sierpiński Carpet. We generalized their result for a n-dimensional Sierpiński Carpet. Then, we are able to show that some groups have a Bowditch boundary homeomorphic to the n-dimensional Sierpiński Carpet.

MARCO BOGGI (UFF, BRAZIL)

Absolute anabelian properties of moduli stacks of curves

Let $\mathcal{M}_{g,n}$, for $2g-2+n>0$, be the moduli stack over $\mathbb{Q}$ of smooth projective n-pointed, genus g curves. For a geometric base point $\xi \in \mathcal{M}_{g,n}$, the étale fundamental group $\pi_1^{et}(\mathcal{M}_{g,n},\xi)$ is an extension of the absolute Galois group $G_{\mathbb{Q}}$ of the rationals by a group isomorphic to the profinite completion $\widehat{\Gamma}_{g,n}$ of the mapping class group $\Gamma_{g,n}$ of a n-pointed, genus g topological surface. In a work in progress, I show that, for $g \leqslant 2$, there is a natural isomorphism:

$$\mathrm{Out}(\pi_1^{et}(\mathcal{M}_{g,n},\xi)) \cong 1\text{-}\,\mathrm{Aut}(\mathcal{M}_{g,n}).$$

Note that we have $\dim \mathcal{M}_{0,3} = 0$ and so $\pi_1^{et}(\mathcal{M}_{0,3},\xi) = G_{\mathbb{Q}}$ and $\mathrm{Aut}(\mathcal{M}_{0,3}) = \{1\}$. Hence, for $(g,n)=(0,3)$, this statement reduces to the well known Neukirch-Uchida theorem. In this talk, I will explain in elementary terms the case $(g,n) = (0,4)$, which corresponds to the isomorphisms:

$$\mathrm{Out}(\pi_1^{et}(\mathbb{P}^1_{\mathbb{Q}} \smallsetminus \{0,1,\infty\},\xi)) \cong \mathrm{Aut}(\mathbb{P}^1_{\mathbb{Q}} \smallsetminus \{0,1,\infty\}) \cong \Sigma_3,$$

where Σ_3 is the symmetric group in 3 letters.

MARÍA AMELIA SALAZAR (UFF, BRAZIL)

Pseudogroups and Geometric structures

Pseudogroups appear as the space of local symmetries of a geometric structure. In this talk I will present a novel framework that uncovers the relevant structure behind Lie pseudogroups and geometric structures, give plenty of different examples and mention some results that we can proof using this formalism. The relevant objects of this framework are Lie groupoids endowed with a multiplicative ”PDE-structure”, in analogy with concepts from Poison geometry such as symplectic groupoids and Hamiltonian spaces.

This is based on joint work with Luca Accornero, Francesco Cattafi and Marius Crainic.

MATIAS DEL HOYO (UFF, BRAZIL)

Filling horns in algebra and geometry

Simplicial objects play a fundamental role in many areas. In topology, they provide combinatorial mo- dels for the homotopy of spaces; in category theory, they give a formalism for weak higher categories; and in algebra, they extend homological methods to non-abelian settings. In this talk, I will discuss simplicial objects, fibrations, and the horn-filling condition, comment on their role in topology and ca- tegory theory, and give special attention to the Dold-Kan correspondence, which sets the foundations of homotopical algebra. Based on joint work with G. Trentinaglia, I will present new formulas, discuss further generalizations, and mention some ongoing projects.

ROSA MARIA MIRÓ-ROIG (UNIVERSITAT DE BARCELONA, SPAIN)

Grobner's problem

In my talk, I will address Grobner's problem. It is a longstanding open problem in commutative algebra and algebraic geometry, posed by W. Grobner in 1969 and it aims to determine whether a (monomial) projection of a Veronese variety is an arithmetically Cohen-Macaulay variety. I will summarize what is known about this problem and explain some recent contributions.

VICTOR PRETTI (IME-USP, BRAZIL)

About quiver regions and instantons

Throughout the past years, understanding the moduli spaces of Bridgeland stable objects has been under deep investigation. The behavior of these moduli spaces is largely still an open problem, despite its success related to the Large volume limit and for instantons of minimal charge, for example, but describing explicit examples of them is still a complicated matter. In attempt to attack this problem, we utilize the monadic description of the instantons of any charge to link μ-stability and Bridgeland stability on the quiver regions. This leads to a moduli space containing the instanton sheaves as a quasi-projective variety.

Posters:

ANDRÉ DANTAS TANURE (IME-USP, BRAZIL)

The category of multiplicative sections of a VB-groupoid

In this work we will review a result of the paper ”On the Lie 2-algebra of sections of an LA-groupoid” from C. Ortiz and J. Waldron, which establishes that the category of multiplicative sections of a VB-groupoid is a 2-vector space.

ÁTILA FELIPE DE SOUZA (UFMG, BRAZIL)

Koszul Cohomology and Clifford index for singular curves

The Clifford Index of a curve C is an invariant that measures its complexity. Strictly speaking, it measures how far is a curve from being hyperelliptic. On the other hand, given a variety X, a line bundle $L \in \mathtt{Pic}(X)$ and a coherent sheaf $\mathcal{F}$, we can define the Koszul complex associated to L. If we verify the resulting Cohomology, it is possible to obtain relevant geometric information. In the 80s, Green established an important conjecture that related these notions. To be precise, he conjectured that given C a projective curve over a field of characteristic zero. So,

$$\mathtt{Clif}(C) > l, \text{if, and only if} K_{p,2}(C, \omega_C) = 0 \; \forall p < l.$$

In this case, ω_C denotes the canonical bundle. This conjecture is interesting, because the relation between intrinsic and extrinsic no- tions becomes clearer. Furthermore, it is a generalization of classic theorems such as Max-Noether and Enriques-Babbage-Petri. For the smooth case, there are strong results by Voisin. Our current work is studying how the Green's Conjecture main ob- jects behave in the singular case. Therefore, some very initial results will be presented.

CAIO AUGUSTO SANTOS MAGALHÃES (UFG, BRAZIL)

On the algebraic classification of homotopy n-types

In this poster, we will discuss the algebraic classification of homotopy n-types for $n = 1, 2$ and 3, where 1-types are classified by groups, 2-types by crossed modules and 3-types by non-Abelian tensor products.

EMMA A. CUPITRA VERGARA (IME-USP, BRAZIL)

The category of multiplicative sections of the canonical CA-groupoid

Our main goal is to describe algebraically the multiplicative sections of CA-groupoids. Motivated by the work [1] on the category of multiplicative sections of VB-groupoids and LA-groupoids, we study the underlying algebraic structure of the category of multiplicative sections of the canonical CA-groupoid.

FABRICIO VALENCIA (IME-USP, BRAZIL)

Isometric Lie 2-group actions on Riemannian groupoids

We present a notion of isometric action of a (strict) Lie 2-group on a Riemannian groupoid. We exhibit an existence result which allows both to obtain a 2-equivariant tubular neighborhood theorem and to construct bi-invariant groupoid metrics on compact Lie 2-groups. Examples, related constructions, and applications will be mentioned. After giving an infinitesimal description for an isometric Lie 2-group action, we define what we call the Lie 2-algebra of weak multiplicative Killing vector fields, an object which is associated with any Riemannian groupoid n-metric. Such an algebra turns out to be Morita invariant, so that it yields a notion of geometric Killing vector field on a quotient Riemannian stack. When the Riemannian stack we are working with is separated it follows that the algebra formed by those geometric Killing vector fields is finite dimensional. Based on joint work with J. S. Herrera-Carmona.

GABRIEL TRINDADE (IME-USP, BRAZIL)

An overview of finite information geometry

Information geometry, a subfield of information science, tackles statistical problems using concepts from differential geometry [1], particularly Riemannian geometry. It was primarily developed from the interpretation of statistical models as differentiable manifolds equipped with a distinguished Riemannian metric [2]. While some approaches stand out for their intrinsic nature, others stem from an extrinsic perspective, considering spaces of finite signed measures, embedding manifolds into these spaces and defining relevant quantities which are present in the intrinsic approach there [3]. The case of finite sample spaces is more straightforward than the infinite one, as differential geometry is performed on structures that are primarily algebraic [3]. In this case, given a non-empty finite set, a Riemannian metric, called the Fisher metric, and a symmetric 3-covariant tensor field, known as the Amari-Chentsov tensor, are defined in the spaces of positive finite measures and probability measures [3]. Both tensor fields are characterized by invariance under a family of maps that, roughly speaking, generalize the notion of sufficient statistics [3]. On the tangent bundle of these spaces, an important one-parameter family of linear connections is also defined, termed the family of alfa-connections and that engenders the Levi-Civita connection of the Fisher metric [1].

References:

[1] NIELSEN, Frank. The Many Faces of Information Geometry. Notices Of The American Mathematical Society, ano 2022, v. 69, n. 1. p. 36-45.

[2] AMARI, Shun-ichi; NAGAOKA, Hiroshi. Methods of Information Geometry. United States of America: American Mathematical Society, v.191, 2000. (Translations of Mathematical Monographs).

[3] AY, Nihat. et al. Information Geometry. Cham: Springer International Publishing, v. 64, 2017. (A Series of Modern Surveys in Mathematics).

JANAÍNE MARTINS (UFMG, BRAZIL)

The classification of Togliatti systems

Classifying smooth varieties that satisfy at least one Laplace equation is a long-standing problem in algebraic and differential geometry. In 1880's Togliatti provided one of the earliest contributions to this problem. He proved that there is one and only one example of a rational surface S in $\mathbb{P}^5$ parametrized by cubics and satisfying a Laplace equation of order 2.

More recently, Miró-Roig, Mezzetti, and Ottaviani proved that there is a relationship between the existence of projective varieties $X \subset \mathbb{P}^N$ satisfying at least one Laplace equation of order $s \geqslant 2$ and the existence of homogeneous Artinian ideals $I \subset K[x_0, \cdots, x_n]$ generated by forms of degree d and that fail the Weak Lefschetz Property (WLP) in degree $d-1$. They proved that an Artinian ideal $I \subset R$ generated by r forms of degree d, $r \leqslant \binom{d+n-1}{n-1}$ fails WLP in degree $d-1$, if and only if the projection of the Veronese manifold $V(n, d)$ by the linear system $|I_d|$, denoted as X_I, has an osculating defect of order $d-1$. In this case, I is called a Togliatti system. This result shed light on the problem of the existence and classification of varieties with osculating defects of order $s \geqslant 2$. In particular, a case of special interest is when the ideal I is monomial, because in this case, its associated variety X_I is toric, and several combinatorial tools can be used for the study of Togliatti systems. In this regard, our main focus for this poster is to discuss the existence of gaps within the allowable range for the minimum number of generators of a Togliatti system and how this contributes to the classification of Togliatti systems.

KAREN DE ALMEIDA FONSECA RODRIGUES (UFF, BRAZIL)

Lie's Three Theorems for Groupoids and Algebroids

Lie's three fundamental theorems for Lie groups and Lie algebras allowed us to conclude that every Lie algebra can be integrated to a simply connected Lie group. In this work we will mainly present ideas from the works of Moerdijk and Mrcun, Crainic and Fernandes that were used for the generalization of these results to Lie Groupoids and Lie Algebroids. We will focus on the first two fundamental theorems which regard the unicity of a source simply connected Lie groupoid integrating a Lie algebra and the integration of morphisms of Lie algebroids. We will also briefly give an idea of the obstructions to the generalization of the third theorem and present the construction from Meirenken of the integration of a transitive Lie algebroid.

LUIZ FELIPE VILLAR FUSHIMI (IME-USP, BRAZIL)

Cartan Structure Groupoids and Algebroids

Klein geometries are a way to model homogeneous spaces through Lie groups, and Cartan geometries are their non-homogeneous generalizations. A Cartan geometry can be interpreted as a H-principal bundle $P \to M$ possessed of a connection 1-form, and therefore its tangent Lie algebroid $TP \to P$ has a H-principal action with a connection 1-form. This motivates the definition of what we call a Cartan structure algebroid, which in turn motivates the definition of a Cartan structure groupoid. We present the definitions and basic properties of these objects, the parallels between them and G-structure groupoids and algebroids with connection, as well as some tentative examples. This is a work in progress for my PhD thesis, written under the supervision of I. Struchiner.

LUIZ HENRIQUE DE SOUZA MATOS (UFMG, BRAZIL)

PI-algebras and multiplicities bounded by one

Let F be a field of characteristic zero, and A be an associative algebra over F. We say that a polynomial in non-commutative variables $f(x_1, \cdots, x_n)$ is a polynomial identity for the algebra A if $f(a_1, \cdots, a_n) = 0$, for all $a_1, \cdots, a_n \in A$. If there exists a non-zero polynomial identity for A, then we say that A is a PI-algebra. If P_n denotes the vector space of multilinear polynomials of degree n in the variables $x_1, \cdots, x_n$ and $Id(A)$ is the set of all polynomial iden- tities of an algebra A, then the quotient space $P_n = \frac{P_n}{P_n \cap Id(A)}$ has a left S_n-module structure. The S_n-character of the space $P_n(A)$ is called the nth cocharacter of the algebra A and is denoted by $\chi_n(A)$. Since F is a field of characteristic zero, it is possible to write

$$\chi_n(A) = \sum_{\lambda \vdash n} m_\lambda \chi_\lambda.$$

where λ is a partition of n, χ_λ is the irreducible S_n-character asso- ciated with λ, and m_λ is the respective multiplicity. In this work, we present an update proof of the result of Ananin and Kemer that characterizes algebras whose multiplicities m_λ in $\chi_n(A)$ are bounded by 1.

MARCOS TÚLIO BARBOSA ABREU (UFMG, BRAZIL)

Teoria de Representações, caracteres e o critério de Burnside para a classificação de grupos simples

No fim do século XIX, I. Schur e F. G. Frobenius desenvolveram a teoria de representações de grupos finitos como uma nova perspectiva no estudo de grupos utilizando-se da teoria de álgebra linear, representando os elementos de um grupo como transformações lineares de espaços vetoriais. Mais precisamente, se G é um grupo finito e V um espaço vetorial de dimensão finita, define-se uma representação de G como um homomorfismo $\varphi : G \to GL(V)$. Um dos grandes triunfos da teoria é o critério "pq" de W. Burnside (1904), o qual afirma que todo grupo G de ordem p , $p^\alpha q^\beta$ primos e é solúvel, i.e., não é simples, a menos que seja cíclico de ordem prima. Objetiva-se com o presente trabalho apresentar a demonstração de Burnside de tal critério, exibindo um subgrupo normal não-trivial próprio de G, e discutir aplicações em teoria de grupos.

PAULA CRISTINA BASÍLIO DA SILVA (UFV, BRAZIL), LIA FEITAL FUSARO ABRANTES (UFV, BRAZIL)

Gonalidade de Curvas Parametrizadas Monomiais Unirramificadas

Este trabalho tem como principal objetivo estudar a gonalidade de curvas parametrizadas monomiais unirramificadas. Inicialmente definiremos a valorização discreta de um elemento $f \in K[[t]]$ e o semigrupo de valores de uma curva unirramificada. Em seguida relacionaremos o anel local da curva com seu semigrupo através da valorização discreta. Daí, definiremos um feixe livre de torsão de posto r e grau d e a gonalidade de uma curva. Finalmente, apresentaremos o resultado principal onde caracterizamos todas as curvas parametrizadas monomiais unirramificadas de gênero até 6 quanto à sua gonalidade.

RAFAEL HERNANDEZ BOLANOS (UFF, BRAZIL)

Three adjoint categories

This poster offers a view over an important concept in category theory: adjoint functors, with a particular emphasis on the widely recognized adjunction between the categories of topological spaces, locals (opposite category of frames) and topological systems. Topological systems provide an intermediate step that is necessary to categorically relate a topological space to a lattice and vice versa. Furthermore, they demonstrate that when discussing continuous functions, it is valuable to consider the algebraic structure preserved in their inverse image.

TIANHAO YE (IMPA, BRAZIL)

Alternative Viewpoint to the Integration of Twisted Dirac Brackets

The correspondence between Poisson structures and symplectic groupoids, analogous to the one of Lie algebras and Lie groups, plays an important role in Poisson geometry. There is an extension of this correspondence to the context of Dirac structures twisted by a closed 3-form. We offer an alternative proof of the correspondence, significantly streamlining the original complex argument. Additionally, we'll provide an intriguing example pertaining to the correspondence.

WENDELL CUNHA CLAUDINO (UFMG, BRAZIL)

Representations of finite groups and the shufflingn problem

Representation theory is an area of active research in Algebra, with applications in several areas of knowledge, in particular, in probability and harmonic analysis. In this work we will give an application of the theory of group representations to the shuffling problem. Namely, do we want to answer the question: How many times do you need to shuffle a deck of n cards to ensure a good shuffle? We will answer this question by studying the random walk in the symmetric group through harmonic analysis.