Book of Abstracts of Plenary Talks
XXV Brazilian Algebra Meeting

State University Campinas, December 3 - 7, 2018

	December 3rd	**December 4th**	**December 5th**	**December 6th**	**December 7th**
8h00 - 8h50:	Mini-courses 2,4,7	Mini-courses 2,4,7	Mini-courses 2,4,7	Mini-courses 2,4,7	Mini-courses 2,4,7
9h00 - 9h50:	Mini-courses 1,3,5,6	Mini-courses 1,3,5,6	Mini-courses 1,3,5,6	Mini-courses 1,3,5,6	Mini-courses 1,3,5,6
9h50 - 10h20:	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
10h30 - 11h20:	Ulrich	Vainsencher	Aljadeff	Pellikaan	Marques
11h30 - 12h20:	Sidki	Hernandez	Panario	Lanzilotta	Korchmaros
12h20 - 14h00:	Lunch	Lunch	Lunch	Lunch	Lunch
14h00 - 15h00:	Sessions	Sessions	Sessions	Chari	Sessions
15h00 - 16h00:	Sessions	Sessions	Sessions	Posters	Sessions
16h00 - 16h30:	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
16h30 - 18h00:	Sessions	Sessions	Sessions	Posters	Sessions

On some computational aspects of PI theory for Associative algebras

Eli Aljadeff (Technion-Israel Institute of Technology - Israel)

Abstract:
Recall that an associative algebra A over a field F is PI if it satisfies a nontrivial polynomial identity, that is there exists a nontrivial element $p(x_1, \ldots, x_n) \in F\langle X\rangle$ (the free algebra on a nonempty set X) which vanishes upon any evaluation on A (e.g. any commutative algebra satisfies the identity $[x, y] = xy - yx$ and so is PI).

Over the years one could identify two main aspects of PI theory.

1. *Structure theorems* which study the properties of algebras satisfying some PI.

2. *Computational aspects* (our main interest in this lecture) which studies the identities satisfied by a given algebra or more generally by a set of algebras.

In this lecture I'll recall the main concepts and terminology, review some of the main results and finally explain some classical and more recent results (jointly with Karasik and Jenssens) in the so called *asymptotic theory*, namely the theory which intends to count in asymptotic terms how many polynomial identities (or nonidentities rather) and algebra

has.

Quantum affine Algebras and Cluster algebras

Vyjayanthi Chari (University of California, Riverside - USA)

Abstract:
In 2009 Hernandez and Leclerc defined certain subcategories $\mathcal{C}_\xi$of finitedimensional representations of a quantum affine algebra. In the case of $\mathfrak{sl}_{n+1}$ these are indexed by a quiver $\mathcal{Q}_\xi$ of type A_n. In the case when the quiver is monotonic or bipartite, they showed that the Grothendieck ring of $\mathcal{C}_\xi$ is isomorphic to a cluster algebra of type A; the isomorphism maps the fundamental representations to an element of the initial seed. In this talk, we shall begin with a gentle introduction to the connection between the two subjects. We will then show that their results hold for arbitrary quivers using very different methods . As a consequence we identify the image of an arbitrary cluster variable and give a closed formula for the cluster variable in terms of the initial seed. In the language of representation theory, this amounts to giving a closed formula for the character of the prime representations in $\mathcal{C}_\xi$. The talk is based on joint work with Matheus Brito.

Spectra of quantum integrable systems, Langlands duality and category O

David Hernandez (Université Paris-Diderot, France)

Abstract:
The spectrum of a quantum integrable system is crucial to understand its properties. R-matrices give power tools to study such spectra. A better understanding of transfer-matrices obtained from R-matrices led us to the proof of several results for the corresponding quantum integrable systems. In particular, their spectra can be described in terms of "Baxter polynomials". They appear naturally in the study of a category O of representation of a Borel subalgebra of a quantum affine algebra. The properties of geometric objects attached to the Langlands dual Lie algebra (the affine opers) led us to establish new relations in the Grothendieck ring of this category O, from which one can derive the Bethe Ansatz equations between the roots of the Baxter polynomials.
(based on joint works with M. Jimbo, E. Frenkel and B. Leclerc)

Large Automorphism Groups of Curves in Positive Characteristic

Gábor Korchmáros (Università della Basilicata - Italy)

Coworker: Massimo Giulietti, Pietro Speziali, Maria Montanucci, Marco Timpanella and Giovanni Zini.

Abstract:
For an (algebraic, projective, absolutely irreducible) curve $\mathcal{X}$ defined over an algebraically closed field K of positive characteristic p, $\mathrm{Aut}(\mathcal{X})$ denotes the group of all automorphisms of $\mathcal{X}$ fixing K element-wise. By a classical result, $\mathrm{Aut}(\mathcal{X})$ is finite if the genus $\mathfrak{g}(\mathcal{X})$ of $\mathcal{X}$ is at least two.

In recent years, some new ideas relying on deeper results about finite groups were developed which made it possible to understand better the structure and action of $\mathrm{Aut}(\mathcal{X})$ on $\mathcal{X}$ especially in the case where the size of $\mathrm{Aut}(\mathcal{X})$ is large enough compared with $\mathfrak{g}(\mathcal{X})$.

In this survey we focus on the following issues:

- Known examples of curves with large automorphism groups;
- Upper bounds on the size of $\mathrm{Aut}(\mathcal{X})$ depending on $\mathfrak{g}(\mathcal{X})$;
- Improvement on upper bounds on the size of $\mathrm{Aut}(\mathcal{X})$ for curves with positive Hasse-Witt invariant.
- The structure of $\mathrm{Aut}(\mathcal{X})$ when $\mathfrak{g}(\mathcal{X})$ is even.

Igusa - Todorov functions

Marcelo Lanzilotta (Universidad de la República - Uruguay)

Abstract:
I will present central points concerning new homological measures called Igusa - Todorov functions. These are natural extensions of the projective (or injective) dimension in suitable categories, as module categories for Artin algebras, categories of comodules over left semiperfect coalgebras, length categories, etc.
My second purpose in this talk is to make precise the relation of these new homological measures with the homological conjectures in the theory of representation algebras.

On some problems proposed by Kurt Mahler

Diego Marques (Universidade de Brasília - Brazil)

Abstract:
In 1976, in the Chapter 3 of his book entitled "Lectures on Transcendental Numbers", Kurt Mahler raised three questions related to the arithmetic behavior of transcendental analytic functions at complex points. He named these questions as Problems A, B and C. These problems are also related to previous works of Weierstrass, Strauss and Stäckel. Mahler also gave some partial results for some of them. In this lecture, we will talk about

these questions as well as our solution (jointly with Carlos Gustavo Moreira) for two of them (Problems B and C).

Open Problems for Polynomials over Finite Fields and Applications

Daniel Panario (Carleton University - Canada)

Abstract:
We survey open problems for polynomials over a finite field. We first comment on the existence and number of several classes of polynomials. The open problems here are of a theoretical nature.

Then, we center in classes of low-weight (irreducible) polynomials. The conjectures here are practically oriented, specially in cryptography.

Finally, we give descriptions of a selection of open problems from several areas including factorization of polynomials, special polynomials (permutation, almost perfect nonlinear), and relations between integer numbers and polynomials.

Linear codes that are defined by quadratic equations

Ruud Pellikaan (Technical University of Eindhoven - Netherlands)

Abstract:
We will review the work on algebraic geometry codes $\mathcal{C} = \mathcal{C}_L(\mathcal{X}, P, E)$ that have a unique representation $(\mathcal{X}, P, E)$, where $\mathcal{X}$ is an algebraic curve, P is an n-tuple of mutually distinct points and E is a divisor. See [1,2,3,4]. As a consequence algebraic geometry codes with certain parameters are not secure for the code based McEliece public crypto system.

One of the key ingredients of these results is the classical fact that certain curves embedded in projective space are defined by quadratic equations. We consider generalizations to higher dimensional varieties [5] and their corresponding codes.

[1] A. Couvreur, I. Márquez-Corbella and R. Pellikaan, Cryptanalysis of public-key cryptosystems that use subcodes of algebraic geometry codes. In *Coding theory and applications*, pp. 133-140, CIM Ser. Math. Sci., 3, Springer, Cham, 2015.

[2] A. Couvreur, I. Márquez-Corbella and R. Pellikaan, Cryptanalysis of McEliece cryptosystem based on algebraic geometry codes and their subcodes. IEEE Trans. Inform. Theory vol. 63, pp. 5404-5418, 2017

[3] I. Márquez-Corbella, E. Martínez-Moro and R. Pellikaan, On the unique representation of very strong algebraic geometry codes. Designs, Codes and Cryptography, vol.70, pp. 215-230, 2014.

[**4**] I. Márquez-Corbella, E. Martínez-Moro, D. Ruano and R. Pellikaan, Computational aspects of retrieving a representation of an algebraic geometry code, J. Symbolic Comput. vol. 64, pp. 67-87, 2014.

[**5**] D. Mumford, Varieties defined by quadratic equations. In: *Questions on Algebraic Varieties*, C.I.M.E., III Ciclo, Varenna, 1969, pp. 29-100. Edizioni Cremonese, Rome 1970.

Self-similarity of groups

Said Sidki (Universidade de Brasília - Brazil)

Abstract:
We will review self-similarity and virtual endomorphisms of groups.
Then we follow with recent results on certain groups which do not admit faithful self-similarity, on new lamplighters and self-similar products of groups. These are based on joint works with A. Dantas, D. Kochloukova and L. Bartholdi.

Bounding degrees of vector fields

Bernd Ulrich (Purdue University - USA)

Abstract:
For the purpose of finding algebraic curves that are left invariant by a vector field in $\mathbb{P}^2_{\mathbb{C}}$, Poincaré asked whether the degree of such curves can be bounded above in terms of the degree of the vector field. Although the question has a negative answer in general, it has inspired a great deal of work for over a century. A broader goal of this research is to relate the degree of vector fields in $\mathbb{P}^n_{\mathbb{C}}$ to properties of curves or even varieties that they leave invariant.

We will survey some of the numerous previous results and report on recent joint work with Marc Chardin, Hamid Hassanzadeh, Claudia Polini, and Aron Simis, where the question is approached from a more algebraic point of view. We provide lower bounds for the degree of vector fields in terms of local and global data of the curves they leave invariant. Higher dimensional varieties are considered as well, and the sharpness of the bounds will be discussed.

Components of the spaces of foliations in $\mathbb{CP}n$

Israel Vainsencher (Universidade Federal de Minas Gerais - Brazil)

Abstract:
Holomorphic foliations of codimension one in the complex projective space are defined by integrable one-forms. Integrability for n¿=3 translates into a system of quadratic equations on the coefficients of the one-form. The quest to describe the irreducible components of the space of solutions of this system of quadratic equations has received some attention since the work by Darboux, Jouanolou, Cerveau-Lins Neto, JVPereira, just to quote a few. Our aim is to describe a few families of components, focusing in the calculation of their degrees.
(Joint with F. Cukierman, J.V. Pereira, A. Rossini, D. Leite)