Abstracts of Posters

Effective Bounds in Representing Algebraic Sets

Eli Amzallag & Mengxiao Sun, City University of New York

A long-standing problem in polynomial computation has been how to efficiently specify a representation of a given algebraic set or of its corresponding ideal without losing any important information about it. In her thesis, Agnes Szanto described and gave bounds for an algorithm that produces a representation of the radical of a given ideal by unmixed triangular sets, which generalize Ritt-Wu characteristic sets. We discuss improvements and effective versions of these bounds. In particular, we give the first numerical upper bounds for the degrees of polynomials and number of components in the output. Since these representations have similar applications, we also compare our bounds to those for computing a Groebner basis. This is joint work with Gleb Pogudin and Ngoc Thieu Vo.

Simply transitive groupoids, parallelisms and Lie connections

David Blázquez-Sanz, Universidad Nacional de Colombia

We introduce the concept of Lie connection associated to a parallelism. We explore the following question. Given a rational parallelism of a variety, is it isogenous to the structural parallelism of an algebraic group? We found an answer in terms of classical Picard-Vessiot theory for linear connections. Thisposteris based in a joint research with Guy Casale from Rennes University.

Truncation in Direct Unions of Hahn Fields with a Derivation

Santiago Camacho, University of Illinois

There is interest in determining embeddings of algebras of germs of functions and valued fields into sets of generalized series in a truncation closed manner, that is if$f$ appears in the image of your embedding, then any truncation of f is again in the image of the embedding. Many preservation results in the ring structure have been established before, that is given a truncation closed subset of generalized series it has been proved that several natural ring

extensions of such subset are still truncation closed. We determine sufficient conditions that guarantee similar results in a differential setting.

Integral Bases for Differential Operators and Normalization at Infinity

Erdal Imamoglu, Florida State University

The goal in this poster is to find a so-called gauge transformation that reduces a complicated differential operator L (with numerous apparent singularities) to a simpler one. To find such gauge transformation, we present a fast algorithm to compute an integral basis of a differential operator L with rational function coefficients, and normalize it at infinity. Examples show that this often reduces L to an operator that is easier to solve.

Some properties of differentially flat systems

François Ollivier, École Polytechnique

Differential flatness is an interesting property shared by many systems encountered in various fields of engineering: cars, cranes, electrical engines .... One is able to parametrize their solutions using arbitrary functions, an idea that goes back to Monge.

Hilbert was the first to request that the parametrization should be locally bijective, introducing also a necessary condition, later generalized by Rouchon to show that flatness is not a generic property.

We present a few recent advances. First, a proof of "endogenous equals exogenous", meaning that the existence of a parametrization implies the existence of a locally bijective one, obtained with Brahim Sadik for systems with two inputs.

Second, the study of the singular points of a flat system, that is the points where no flat parametrization exists, started with Jean Lévine and Jeremy Kaminsky. For the car, the only singular points are those where the car does not move, for which we lose first order controllability.

We conclude with a generalized version of Rouchon criterion, obtained with Brahim Sadik, that provides a complete flatness criterion for systems with two inputs and a state of dimension 3. As for Cartan's criterion, flat outputs are first integral common to a family of derivations. New algorithms, developed with Guillaume Chèze, allow to test if rational flat outputs of a given degree exist.

Perspectives on Painlevé VI: Arithmetic versions after Buium-Manin, and algebraic non-integrability

Emma Previato, Boston University

Painlevé VI is a non-linear differential equation closely connected with elliptic curves. A. Buium and Y. Manin recently used this fact to give arithmetic-differentiation versions of it. We present recent work by several schools on the Hamiltonian flow that produces the equation, with results on non-integrability and proposals for an arithmetic theory.

A modified Rota-Baxter identity

Clemens Raab, RICAM Linz

We consider differential algebras with a linear right-inverse of the derivation. As a special case we also obtain integro-differential algebras, which in addition require the induced evaluation to be multiplicative. The general setting allows to model functions with singularities in the evaluation point. We describe our two-level generalization of Bergman?s tensor reduction systems, which can be applied for modelling algebras of linear operators. Using a completion process similar to Buchberger's algorithm, we systematically compute consequences of the defining relations. One such consequence is a modified Rota-Baxter identity that contains an additional evaluation term. For integration on continuous functions, the standard Rota-Baxter identity without evaluation term holds. We also show how the extra term affects other well-known formulae like the Taylor formula or the shuffle relations. This is joint work in progress with Georg Regensburger.

Proof mining effective bounds in differential polynomial rings

William Simmons, University of Pennsylvania

Nonconstructive proofs, such as those involving ultraproducts, often contain a "hidden combinatorial core". Techniques from proof theory can systematically expose this effective content. In joint work with Henry Towsner we have examined nonstandard proofs of theorems like the differential Nullstellensatz, giving an alternative perspective on recent results of Freitag, Gustavson, Leon Sanchez, Kondratieva, Ovchinnikov, and others.