ABSTRACT

Deformations and their controlling cohomologies of $\mathcal{O}$-operators

Cheng-Ming Bai

(Nankai University, China)

Abstract: We establish a deformation theory of a kind of linear operators, namely, $\mathcal{O}$-operators in consistence with the general principles of deformation theories. On one hand, there is a suitable differential graded Lie algebra whose Maurer-Cartan elements characterize $\mathcal{O}$-operators and their deformations. On the other hand, there is an analogue of the André-Quillen cohomology which controls the deformations of $\mathcal{O}$-operators. Infinitesimal deformations of $\mathcal{O}$-operators are studied and applications are given to deformations of skew-symmetric r-matrices for the classical Yang-Baxter equation. This is a joint work with Li Guo, Yunhe Sheng and Rong Tang. .

Computation without Representation

Dror Bar-Natan

(University of Toronto, Canada)

Abstract: A major part of "quantum topology" (you don't have to know what's that) is the definition and computation of various knot invariants by carrying out computations in quantum groups (you don't have to know what are these). Traditionally these computations are carried out "in a representation", but this is very slow: one has to use tensor powers of these representations, and the dimensions of powers grow exponentially fast.

In my talk, I will describe a direct-participation method for carrying out these computations without having to choose a representation and explain why in many ways the results are better and faster. The two key points we use are a technique for composing infinite-order "perturbed Gaussian" differential operators, and the little-known fact that every semi-simple Lie algebra can be approximated by solvable Lie algebras, where computations are easier.

This is joint work with Roland van der Veen and continues work by Rozansky and Overbay.

URL: http://drorbn.net/hef18

Calabi-Yau algebras and the shifted noncommutative symplectic structure

Xiao-Jun Chen

(Sichuan University, China)

Abstract: The notion of Calabi-Yau algebras was introduced by Ginzburg in 2007 and has widely been studied since then. In this talk, we show that for a Koszul Calabi-Yau algebra, there is a shifted bi-symplectic structure on the cobar construction of its co-unitalized Koszul dual coalgebra, and hence its DG representation schemes have a shifted symplectic structure, in the sense of Pantev et. al. The talk is based on a joint work with F. Eshmatov.

Gröbner-Shirshov bases and their calculation

Yu-Qun Chen

(South China Normal University, China)

Abstract: Our main topic is Gröbner-Shirshov bases method for different varieties (categories) of linear (Ω-) algebras over a field k or a commutative algebra K over k: associative algebras (including group (semigroup) algebras), Lie algebras, dialgebras, conformal algebras, pre-Lie (Vinberg right (left) symmetric) algebras, Rota-Baxter algebras, metabelian Lie algebras, L-algebras, semiring algebras, category algebras, Leibniz algebras, Novikov-Poisson algebras, etc. Gröbner-Shirshov bases method is a powerful tool to solve the following classical problems: normal form; word problem; conjugacy problem; rewriting system; automaton; embedding theorem; PBW theorem; extension; homology; growth function; Dehn function; complexity; etc. There are some applications particularly to new proofs of some known theorems.

As an example, we give a construction of a free digroup $F(X)$ on a set X by using Gröbner-Shirshov bases theory for dialgebras, where a digroup is a set G equipped with two binary operations $\vdash$ and $\dashv$, a unary operation $\dagger$, and a nullary operation 1, satisfying $(G, \vdash)$ and $(G, \dashv)$ are both semigroups, and the following identities: $a \dashv (b \vdash c) = a \dashv (b \dashv c)$, $(a \dashv b) \vdash c = (a \vdash b) \vdash c$, $a \vdash (b \dashv c) = (a \vdash b) \dashv c$, $1 \vdash a = a = a \dashv 1$, $a \vdash a^{\dagger} = 1 = a^{\dagger} \dashv a$.

I will mention Gröbner-Shirshov bases theory for operads established by [Dotsenko, V., Khoroshkin, A.: Gröbner bases for operads. Duke Math. J. 153, 363 – 396 (2010)].

Right adjoints to restriction of algebras

Gabriel C. Drummond-Cole

(IBS Center for Geometry and Physics , South Korea)

Abstract: I will describe a concise necessary and sufficient condition for the existence of an exceptional right adjoint to the restriction of algebras functor induced by a map of operads, give a simple formula for the adjoint, and provide examples where the criterion holds. This is joint work in progress with Philip Hackney.

Mapping spaces of E_n-operads and graph complexes

Benoit Fresse

(Université de Lille, France)

Abstract: TBA .

Analytic monads and infinity operads

David Gepner

(Purdue University, USA)

Abstract: We develop a higher categorical version of the theory of polynomial and analytic monads, initial algebras, and free monads. Using this machinery we show that infinity-operads are precisely analytic monads. This is joint work with Rune Haugseng and Joachim Kock.

Rota's classification problem of operators and Gröber-Shirshov bases of operads

Xing Gao

(Lanzhou University, China)

Abstract: Motivated by the important roles played by various linear operators in the study of mathematics through their actions on objects, Rota in 1995 posed the problem of finding all possible algebraic identities that can be satisfied by a linear operator on an algebra, henceforth called Rota's Classification Problem. We applied

the methods of Gröbner-Shirshov bases and rewriting systems to study Rota's Classification Problem. As a natural generalization of this approach, we are led to study Gröbner-Shirshov bases and rewriting systems of operads with non-trivial unitary operations. We report progresses on this subject in this talk. The talk is based on a joint work with Li Guo.

Some results and problems on non-reduced operads

Li Guo

(Rutgers University, USA)

Abstract: Most studies on operads have been on reduced operads, namely those for which the 0-ary and unary operations are the trivial ones. There are many examples and applications of non-reduced operads, but their general theory still needs to be established. In this talk, we discuss some results and problems on operads with non-trivial unary operations.

Homotopy theory of linear cogebras

Damien Lejay

(IBS Center for Geometry and Physics , South Korea)

Abstract: Following a long tradition, the homotopy theory of algebras over an operad can be studied using a model category structure on cogebras over cooperads via the Bar adjunction. For example the homotopy theory of dg-Lie algebras can be endoded via locally conilpotent cocommutative cogebras. Dualising the theory, we shall see how the homotopy theory of cogebras overs operads can be studied using a new notion: complete algebras over cooperads.

Operadic categories

Martin Markl

(Czech Academy of Sciences, Czech)

Abstract: I will review basic features of operadic categories that were introduced by Batanin and Markl as an attempt for general theory of "operad-like" structures. By them we mean, besides the classical operads in the sense of Boardman-Vogt and May

and their more recent variants as cyclic, modular or wheeled operads, also diverse versions of PROPs such as properads, dioperads, 1/2-PROPs, and still more exotic stuff as permutads or protoperads. Also Batanin's n-operads appear in the scope of the presented theory.

Splitting and replicating of operads

Jun Pei

(Southwest University, China)

Abstract: We briefly summarize recent constructions of splittings and replicatings of binary quadratic operads and relate them to Manin products. The two procedures are also generalized to any algebraic operads.

A model for the genius 0 Teichmüller tower

Marcy Robertson

(University of Melbourne, Australia)

Abstract: We give an example of an infinity operad which models the genus 0 Teichmüller tower. As evidence, we show that the group of homotopy automorphisms of this operad is isomorphic to the (profinite) Grothendieck-Teichmüller group. Going further, we show that there's a nontrivial action if the absolute Galois group on this operad. This is joint work with Pedro Boavida de Brito and Geoffroy Horel.

Homotopical applications of convolution

Chris Rogers

(University of Nevada, Reno, USA)

Abstract: The Berger-Moerdijk convolution operad provides a conceptual origin for several important L_∞-algebras that arise in deformation theory and homotopy theory in characteristic zero. In many cases of interest, these L_∞-algebras are filtered (and complete). In this talk, I will first recall how filtered L_∞-algebras and (weak) L_∞-morphisms form a category of fibrant objects for a homotopy theory. This allows one to upgrade the simplicial Maurer-Cartan functor, which sends L_∞-algebras to Kan complexes, to an exact functor between categories of fibrant objects.

I will then discuss a few applications that naturally follow by combining the above result with the theory of convolution L_∞-algebras. One such application is a simple ∞-categorical existence and uniqueness statement for homotopy transferred structures. Another is an explicit comparison between two models for the moduli space of rational homotopy types. The latter application is joint work in progress with He Wang (UNR).

Twilled Leibniz algebras, L-infty-algebras and applications to Leibniz bialgebras, average and Kupershmidt operators

Rong Tang

(Jilin University, China)

Abstract: In this talk, we study (proto-, quasi-)twilled Leibniz algebras and the associated L-infty-algebras and differential graded Lie algebras. There are three applications: first we study the twilled Leibniz algebra corresponding to the hemisemidirect product of a Lie algebra and its representation. We show that average-operators on this Lie algebra can be characterized as Maurer-Cartan elements of the associated gLa. Consequently, an average-operator will give rise to a dgLa that can control its deformations. Then we study the twilled Leibniz algebra corresponding to the semidirect product of a Leibniz and its representation. We show that Kupershmidt operators on this Leibniz algebra can be characterized as Maurer-Cartan elements of the associated gLa. Similarly, a Kupershmidt operator will give rise to a dgLa that can control its deformations. Finally, we give the notion of a Leibniz bialgebra and show that matched pairs of Leibniz algebras, quadratic twilled Leibniz algebras and Leibniz bialgebras are equivalent. We further define classical Leibniz-Yang-Baxter equation, classical Leibniz r-matrix and triangular Leibniz bialgebras using the associated gLa and the twisting theory of twilled Leibniz algebras. We introduce the notion of a Leibniz-dendriform algebra as the algebraic structure underlying a Kupershmidt operator, by which we can construct solutions of the classical Leibniz-Yang-Baxter equation.

Algebras over operads and BV-algebras

Alexander A. Voronov

(University of Minnesota, USA)

Abstract: One of the basic examples of a BV-algebra is the Chevalley-Eilenberg complex $S(\mathfrak{g}[-1])$ of a Lie algebra $\mathfrak{g}$, the Chevalley-Eilenberg differential playing the role of the BV operator. Terilla, Tradler, and Wilson observed in 2011 a similar phenomenon occurring for an associative algebra A: its bar complex $T(A[-1])$ is naturally a BV-algebra. We show that, under pretty general assumptions about a quadratic operad $\mathcal{O}$, the bar complex of an $\mathcal{O}$-algebra V also carries a natural BV-algebra structure. We also relate this observation to deformation theory. This is a joint work with Lucy Yang.

Tate-Hochschild cohomology

Zheng-Fang Wang

(Peking University, China)

Abstract: The Tate-Hochschild cohomology of a singular space X is defined as the graded endomorphism ring of the diagonal inside the singularity category of X x X. Singularity categories, which are introduced by Buchweitz and independently by Orlov, have played a central role in noncommutative geometry and homological mirror symmetry.

In this talk, we construct an explicit complex to compute the Tate-Hochschild cohomology. We prove that this complex is an algebra over the little 2-discs operad, namely, the Deligne conjecture for this complex holds. We will also talk about a joint work with M. Rivera that the Tate-Hochschild cohomology of a simply-connected closed manifold recovers the Rabinowitz-Floer homology of the unit disc cotangent bundle.

Poisson cohomology of isolated singularities and counter-examples to Happel's question

Guo-Dong Zhou

(East China Normal University, China)

Abstract: We will talk about two results about Poisson cohomology. In the first part, following P. Monnier, we compute the Gerstenhaber algebra structure over the Poisson cohomology of certain isolated singularities. In the second part, we show how to use the interplay between Poisson cohomology and Hochschild cohomology to

construct counter-examples to Happel's question. This talk is based on joint work with Zi-Hao Qi.