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Doubles for filtered Hopf algebras and a Hopf algebroid of formal differential operators

Abstract

Drinfeld doubles and Heisenberg doubles are standard constructions taking as input any finite dimensional Hopf algebra. There are some extensions to infinite-dimensional setup, where the underlying vector space is the tensor product of the Hopf algebra and of some version of its dual, say a finite (Hopf) dual. We study the construction where the Hopf algebra is infinite dimensional but filtered with finite dimensional filtration pieces, what allows to consider the full algebraic dual as a Hopf algebra in the category of cocomplete cofiltered vector spaces equipped with an interesting monoidal structure. Many theorems from finite dimensional situations generalize here. In particular, our version of Heisenberg double becomes a topological Hopf algebroid. Our motivating examples are doubles for enveloping algebras of Lie algebras; they appear in role of the phase space algebras for "Lie type" noncommutative spaces in physics literature. The full Hopf algebroid in that case can be studied geometrically in the language of differential operators in formal neighborhood of identity of a Lie group. Interplay between the left and the right invariant differential operators reflects in a construction of certain cocomplete Yetter–Drinfeld module algebra structure analogous to YD module algebras in similar earlier constructions of Lu and Brzezinski–Militaru in non-cofiltered situations. This is a joint work with my student Martina Stojic.