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Quantum Deformation of BRST Algebra*

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Abstract. We investigate the q-deformation of the BRST algebra, the algebra of the ghost, matter and gauge fields on one spacetime point using the result of the bicovariant differential calculus. There are two nilpotent operations in the algebra, the BRST transformation δ_B and the derivative d. We show that one can define the covariant commutation relations among the fields and their derivatives consistently with these two operations as well as the $*$-operation, the antimultiplicative inner involution.

0. Introduction

It is an interesting question whether one can construct a q-analogue of the gauge theory by taking the quantum group [Dri, FRT, Jim, Wor1] as a symmetry. One of the interesting possibilities of such a q-deformed theory is that the deformation parameter q may play a role of a regularization parameter. Furthermore, since the quantum group is provided by a noncommutative algebra, in such a theory the noncommutative geometry [Connes] plays a basic role like the differential geometry in the usual gauge theory.

There are some proposals to this problem [Are, Ber, Hira, IP, WuZ]. However, it seems that there are still conceptual problems concerning the definition of the gauge transformation when we take the quantum group as an algebraic object of the gauge symmetry. Since the quantum group is formulated in the language of the Hopf algebra, it forces us to formulate the whole theory in an appropriate algebraic language [BM]. Thus the gauge transformation will be represented in an abstract language and the term of the transformation parameter becomes obscure. Even when we consider only the infinitesimal transformation, we have still the question of the definition of the infinitesimal parameters.

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