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POISSON COHOMOLOGY OF SCALAR MULTIDIMENSIONAL DUBROVIN-NOVIKOV BRACKETS

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Abstract. We compute the Poisson cohomology of a scalar Poisson bracket of Dubrovin-Novikov type with D independent variables. We find that the second and third cohomology groups are generically non-vanishing in $D > 1$. Hence, in contrast with the $D = 1$ case, the deformation theory in the multivariable case is non-trivial.

Contents

1. Introduction

The multidimensional Dubrovin-Novikov (DN) type Poisson brackets were introduced by Dubrovin and Novikov in [7, 8].

Let $x = (x^1, \dots, x^D)$ be coordinates on the torus T^D and $u = (u^1, \dots, u^N)$ be variables on an open ball $U \subset \mathbb{R}^N$ (or more generally local coordinates on a smooth N-dimensional manifold M). The Dubrovin-Novikov brackets are of the form

$$\{u^i(x), u^j(y)\} = \sum_{\alpha=1}^{D} \Big(g^{ij\alpha}(u(x))\partial_{x^\alpha}\delta(x-y) + b_k^{ij\alpha}(u(x))\partial_{x^\alpha}u^k(x)\delta(x-y) \Big) \tag{1}$$