g-SYMPLECTIC ORBITS AND A SOLUTION OF THE BRST CONSISTENCY CONDITION

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Abstract. For any Lie algebra g we introduce the notion of g-symplectic structures and show that every orbit of a principal G-bundle carries a natural g-symplectic form and an associated momentum map induced by the Maurer–Cartan form on G. We apply this to the BRST bicomplex and show that the associated momentum map is a solution of the Wess–Zumino consistency condition for the anomaly.

1. Introduction

We first introduce the notion of Lie algebra g-valued symplectic structures and show that every orbit of a principal G-bundle carries a natural g-symplectic form, which is exact and induced from the Maurer–Cartan form on the Lie group G. The G-action has a natural momentum map which is an invariant for any fundamental vector field. In order to give a solution to the BRST (Wess–Zumino) consistency condition, we generalize these results to infinite dimensional group G of gauge transformations which acts on g-valued differential forms. On these orbit spaces we have the natural g-valued 1-form Θ, induced by the Maurer–Cartan form on the Lie group G, and the corresponding momentum map. We summarize the classical BRST transformations described as coboundary operator of the Chevalley–Eilenberg complex of the infinite dimensional Lie algebra g of infinitesimal gauge transformations, [10–12]. Next we describe the chiral anomaly as element of the first cohomology of the local BRST complex [11, 12] using an induced representation of g on local forms. We consider the Wess–Zumino consistency condition as a problem in this BRST cohomology. To find a solution we combine the BRST bicomplex with the idea of g-valued symplectic geometry and momentum maps. We show that