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How to add "ghosts" in BRST reduction ? —-A remark on semi-infinite cohomology

The rigorous mathematical definition of semi-infinite cohomology was introduced by B. Feigin in 1984, it can be considered as the counterpart of BRST reduction in physics. Unlike ordinary Lie algebra cohomology, computing semi-infinite cohomology requires that the Lie algebra admits a semi-infinite structure. Roughly speaking, a semi-infinite structure is a Lie algebra module structure on the space of semi-infinite forms, and the requirement of such a structure is to make the BRST differential nilpotent, i.e., square zero, which is essential in cohomology theory.

What about if the Lie algebra admits no semi-infinite structure? One way to adjust this is to consider some one-dimensional central extension, which is called cancellation of anomalies in physics. Another way is, as the physicists already did, to add more "ghosts", hence to modify the BRST complex, and then to make a deformation of the BRST differential to make it nilpotent.

In my talk, I will take affine W-algebras as the example, to explain how to add "ghosts" and how to modify the BRST differential in a rigorous mathematical way. As a byproduct, we will give a uniformed definition of affine W-algebras in general nilpotent element case. This is based on our recent work "*A remark on semi-infinite cohomology.*" arXiv:1712.05484.