Partial Classification of Irreducible Modules for Loop-Witt Algebras

Consider the Lie algebra of the group of diffeomorphisms of a \( n \)-dimensional torus which is also known as the derivation algebra of the Laurent polynomial algebra \( A \) over \( n \) commuting variables, denoted by \( \text{Der} A \). In this paper we consider the Lie algebra \((A \ltimes \text{Der} A) \otimes B\) for some commutative associative unital algebra \( B \) over \( \mathbb{C} \) and classify all irreducible modules for \((A \ltimes \text{Der} A) \otimes B\) with finite dimensional weight spaces under some natural conditions. In particular, we show that Larsson’s constructed modules of tensor fields exhaust all such irreducible modules for \((A \ltimes \text{Der} A) \otimes B\).

Keywords: Witt algebra, Virasoro algebra, current algebra.

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