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Graded-simple modules via the loop construction

Twisted loop and multiloop algebras play an important role in the theory of infinite-dimensional Lie algebras. Given a grading by the cyclic group $\mathbb{Z}/m\mathbb{Z}$ on a semisimple Lie algebra, the loop construction produces a \mathbb{Z} -graded infinite-dimensional Lie algebra.

This construction was generalized by Allison, Berman, Faulkner and Pianzola to arbitrary nonassociative algebras and arbitrary quotients of abelian groups. In particular, their results, together with the recent classification of gradings by abelian groups on finite-dimensional simple Lie algebras over an algebraically closed field of characteristic zero, yield a classification of finite-dimensional graded-simple Lie algebras.

Mazorchuk and Zhao have recently applied an analogue of the loop construction to modules. In this talk, we will show how this leads to a classification of finite-dimensional graded-simple modules over semisimple Lie algebras with a grading. This is joint work with Alberto Elduque.