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Abstract

Lie algebras of order 3 constitute a generalization of Lie algebras and superalgebras. Throughout this paper the classification problem of filiform Lie algebras of order 3 is considered and therefore this work is a continuation papers seen in the literature. We approach this classification by extending Vergne's result for filiform Lie algebras and by considering algebras of order 3 of high nilindex. We find the expression of the law to which any elementary filiform Lie algebra of order 3 is isomorphic.

Keywords: Deformations, filiform, isomorphism classes, Lie algebra, Lie algebra of order F , nilpotence

1. Introduction

The generalizations of Lie theory that have been proven to have important physics applications are, among others, color Lie superalgebras [1, 2, 3, 4], n -Lie algebras [5, 6] and Lie algebras of order F [7, 8, 9]. In general, the present work is focused on Lie algebras of order F and, in particular, on Lie algebras of order 3. These algebras constitute the underlying algebraic structure of fractional supersymmetry [10, 11, 12, 13].

From a mathematical point of view, these algebras constitute a generalization of Lie algebras and superalgebras. In Lie superalgebras, as well as in others generalizations of Lie theory, the classification problem and the “filiform” concept have been broadly studied [14, 15, 16, 17, 18, 19]. It must be noted that, even today, the classification problem for nilpotent Lie algebras, and consequently for any generalization of them, as is the case studied in this paper, is an open problem. The first description of filiform Lie algebras was given by Vergne [20] in the 70s; she proved that an arbitrary filiform Lie algebra can be obtained as a linear deformation of the model Lie algebra. The same result is true for the Lie superalgebra case [21].

The filiform Lie algebras of order 3, on the other hand, were introduced in [22] and [23] and the present work constitutes a continuation of those works.

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