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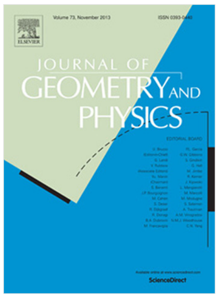

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On $\mathfrak{osp}(2|2)-$relative cohomology of the Lie superalgebra of contact vector fields and deformations

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Abstract

We consider the $1|2$-dimensional real superspace $\mathbb{R}^{1|2}$ endowed with its standard contact structure defined by the 1-form α. The conformal Lie superalgebra $\mathcal{K}(2)$ acts on $\mathbb{R}^{1|2}$ as the Lie superalgebra of contact vector fields; it contains the Möbius superalgebra $\mathfrak{osp}(2|2)$. We classify $\mathfrak{osp}(2|2)$-invariant superskew-symmetric binary differential operators from $\mathcal{K}(2) \wedge \mathcal{K}(2)$ to $\mathfrak{D}_{\lambda,\mu}$ vanishing on $\mathfrak{osp}(2|2)$, where $\mathfrak{D}_{\lambda,\mu}$ is the superspace of linear differential operators between the superspaces of weighted densities. This result allows us to compute the second differential $\mathfrak{osp}(2|2)$-relative cohomology of $\mathcal{K}(2)$ with coefficients in $\mathfrak{D}_{\lambda,\mu}$. We study generic formal $\mathfrak{osp}(2|2)$-trivial deformations of the $\mathcal{K}(2)$-module structure on the direct sum of the superspaces of weighted densities. This work is the simplest superization of a result by Bouarroudj [On sl(2)-relative cohomology of the Lie algebra of vector fields and differential operators, J. Nonlinear Math. Phys., **14:1**, 1-19 (2007)].

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1 Introduction

The space of weighted densities with weight λ (or λ-densities) on $\mathbb{R}$, denoted by:

$$\mathcal{F}_\lambda = \left\{ f(dx)^\lambda \mid f \in C^\infty(\mathbb{R}) \right\}, \quad \lambda \in \mathbb{R},$$

is the space of sections of the line bundle $(T^*\mathbb{R})^{\otimes\lambda}$ for positive integer λ. Let Vect($\mathbb{R}$) be the Lie algebra of all vector fields $X_F = F\frac{d}{dx}$ on $\mathbb{R}$, where $F \in C^\infty(\mathbb{R})$. The *Lie derivative* L_{X_F} along the vector field X_F makes $\mathcal{F}_\lambda$ a Vect($\mathbb{R}$)-module for any $\lambda \in \mathbb{R}$:

$$L_{X_F}(f(dx)^\lambda) = L^\lambda_{X_F}(f)(dx)^\lambda \quad \text{with} \quad L^\lambda_{X_F}(f) = Ff' + \lambda F'f, \tag{1.1}$$

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