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Concept of Lie Derivative of Spinor Fields. A Geometric Motivated Approach

Summary

Using the Clifford bundle ($\mathcal{C}\ell(M,\mathbf{g})$) and spin-Clifford bundle ($\mathcal{C}\ell_{\mathrm{Spin}^e_{1,3}}(M,\mathbf{g})$) formalisms, which permit to give a meaningful representative of a Dirac-Hestenes spinor field (even section of $\mathcal{C}\ell_{\mathrm{Spin}^e_{1,3}}(M,\mathbf{g})$) in the Clifford bundle, in this lecture we give a geometrically motivated definition for the Lie derivative of spinor fields in a Lorentzian structure $(M,\boldsymbol{g})$, where M is a manifold such that $\dim M = 4$ and $\boldsymbol{g}$ is Lorentzian of signature $(1,3)$. Our Lie derivative, called the spinor Lie derivative (and denoted $\overset{s}{\pounds}_{\boldsymbol{\xi}}$) is given by nice formulas when applied to Clifford and spinor fields, and moreover $\overset{s}{\pounds}_{\boldsymbol{\xi}}\boldsymbol{g} = 0$ for any vector field $\boldsymbol{\xi}$. We compare our definitions and results with the many others appearing in the literature on the subject.