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Computation and Application of the Fundamental Invariants of Vector Spaces of Conformal Killing Vectors

Let $\mathcal{C}(M)$ be the vector space of conformal Killing vectors defined on a pseudo-Riemannian manifold M of constant curvature. Consider the action of the isometry group $I(M)$ on $\mathcal{C}(M)$. If we employ the method of infinitesimal generators, the problem of finding fundamental invariants and covariants reduces to solving a system of first order linear homogeneous PDEs.

In theory, the method of characteristics may be used to find solutions, however in practice it proves ineffective due to the sheer size of the system. Alternatively, if the invariants or covariants may be represented by polynomials, the problem reduces further to solving a system of linear equations.

The successful application of this alternative to find invariants for all such $\mathcal{C}(M)$ in dimensions 3, 4 and 5 will be discussed. In addition, the cases where these invariants have been used to distinguish between equivalence classes in certain $\mathcal{C}(M)$ will be shown.