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SOME RESULTS ON COSYMPLECTIC MANIFOLDS ADMITTING CERTAIN VECTOR FIELDS

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Abstract. The purpose of present paper is to study cosymplectic manifolds admitting certain special vector fields such as holomorphically planar conformal (in short HPC) vector field. First, we prove that an HPC vector field on a cosymplectic manifold is also a Jacobi-type vector field. Then, we obtain the necessary conditions for such a vector field to be Killing. Finally, we give an important characterization for a torse-forming vector field on such a manifold given as to be recurrent.

MSC: 53C15, 53D15
Keywords: Cosymplectic manifold, holomorphically planar conformal vector field, Jacobi-type vector field, torse-forming vector field

1. Introduction

The theory of the manifolds is one of the most comprehensive and notable fields of the studies of differential geometry since manifolds explain space in terms of simpler and easily understandable structures. It is well known that there are many special classes of the manifolds with different structures and names. One of them is almost contact metric manifolds, which have contributed to many disciplines such as string and knot theory, thermodynamics and fluid mechanics, optics, control systems, hydrodynamics, molecular biology and heat flow. Hence, many geometers have given their attention to such manifolds recently.

Over the past few years, several various kinds of almost contact metric manifolds have been investigated and studied widely. One important kind of them is the almost cosymplectic manifolds that introduced by Goldberg and Yano. The simplest examples of such manifolds are the products of almost Kähler manifolds and the real $\mathbb{R}$ line or the circle $\mathbb{S}^1$. Almost cosymplectic manifolds are almost contact metric manifolds whose the structure tensor fields satisfy $\mathrm{d}\eta = \mathrm{d}\Phi = 0$, where Φ is the fundamental two form of the manifold given by $\Phi(.,.) = g(.,\varphi.)$. Also, it is well known that normal almost cosymplectic manifolds are cosymplectic manifolds, which are known as the analogues of the Kähler manifolds in odd dimensions. Several mathematicians have studied the properties of almost cosymplectic

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