Conharmonic Tensor of Certain Classes of Almost Hermitian Manifold

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Abstract. Most of the conharmonic tensor studies are applied on Riemannian space. In this work we investigated the conharmonic curvature tensor of some more specific important classes, In particular, the nearly Kahler and almost Kahler manifolds. Firstly, three special classes of almost Hermitian manifold depending on conharmonic tensor have been defined. We found the relation between these classes and the class nearly Kahler manifold. The conharmonic recurrent of nearly Kahler manifold has been studied. Secondly, we found the necessary condition where an almost Kahler manifold is a manifold of a pointwise holomrphic conharmonic tensor.

Keywords. Conharmonic tensor, nearly Kahler manifold, almost Kahler manifold.
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1- Introduction

It is well known that harmonicity of functions is not preserved by the conformal transformation (a harmonic function is a function whose Laplacian vanishes). Related to this fact, Ishi [5] has studied conharmonic transformation that preserves the harmonicity of a certain function. There is a tensor that remains invariant under conharmonic transformation for an n-dimensional Riemannian differentiable manifold which is called a conharmonic curvature tensor. In [6] it is proved that conharmonic curvature tensor is invariant under conharmonic transformation. In 1999, Agaoka and others [2] studied the twisted product manifold with vanishing conharmonic curvature tensor. In 2010, Siddiqui and Ahsan[12] investigated the conharmonic curvature tensor on the 4-dimensional space-time of general relativity that satisfying the Einstein field equations, in particular, they studied the space-time with vanishing coharmonic curvature tensor.

2- preliminaries

Definition 2.1 [4]. Let $\{M, J, g = \langle \cdot, \cdot \rangle\}$ be an almost Hermitian manifold *(AH-*manifold). An almost Hermitian structure (*AH*-structure) $\{J, g\}$ is called a nearly Kähler structure (*NK*-structure) if the fundamental form $\Omega(X,Y) = \langle X, JY \rangle$ is Killing form, or that equivalent to $\nabla_X(J)X = 0$. A smooth manifold with *NK*-structure is called a nearly Kahler manifold (*NK*-manifold) .

By the Banaru's classification of *AH*-manifold [3], the class *NK*-manifold satisfies the condition $B_c^{ab} = 0$, $B^{abc} = -B^{bac}$, where B_c^{ab} and B^{abc} are virtual and structure tensors in the adjoint *G*–structure space or are called Kirichenko's tensors. More details about ajoint G-structure space could be seen in [7] and [1].

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