

A NOTE ON WARPED PRODUCT SUBMANIFOLDS OF KENMOTSU MANIFOLDS

VIQAR AZAM KHAN* — KHALID ALI KHAN** — SIRAJ-UDDIN***

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ABSTRACT. Warped product manifolds are known to have applications in Physics. For instance, they provide an excellent setting to model space-time near a black hole or a massive star (cf. [HONG, S. T.: *Warped products and black holes*, Nuovo Cimento Soc. Ital. Fis. B **120** (2005), 1227–1234]). The studies on warped product manifolds with extrinsic geometric point of view are intensified after B. Y. Chen's work on CR-warped product submanifolds of Kaehler manifolds. Later on, similar studies are carried out in the setting of Sasakian manifolds by Hasegawa and Mihai. As Kenmotsu manifolds are themselves warped product spaces, it is interesting to investigate warped product submanifolds of Kenmotsu manifolds. In the present note a larger class of warped product submanifolds than the class of contact CR-warped product submanifolds is considered. More precisely the existence of warped product submanifolds of a Kenmotsu manifold with one of the factors an invariant submanifold is ensured, an example of such submanifolds is provided and a characterization for a contact CR-submanifold to be a contact CR-warped product submanifold is established.

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1. Introduction

In [1], R. L. Bishop and B. O'Neill introduced the notion of warped product manifolds by homothetically warping the product metric of a product manifold $B \times F$ on the fibers $p \times F$ for each $p \in B$. These manifolds appear in differential geometric studies in a natural way. Ever since S. Nölker [15] gave an explicit description of the warped product representation of Euclidean space, there followed studies of warped product spaces both with intrinsic and extrinsic

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