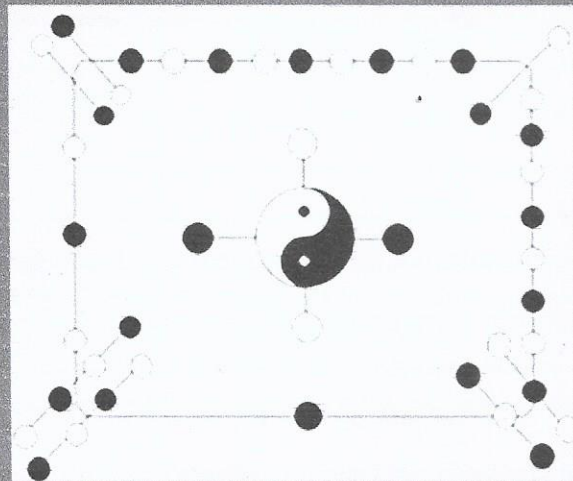




ISSN 1937 - 1055

VOLUME 2, 2019

INTERNATIONAL JOURNAL OF
MATHEMATICAL COMBINATORICS



EDITED BY

THE MADIS OF CHINESE ACADEMY OF SCIENCES AND
ACADEMY OF MATHEMATICAL COMBINATORICS & APPLICATIONS, USA

June, 2019

D-homothetic Deformations of Lorentzian Para-Sasakian Manifold

Barnali Laha

(Department of Mathematics, Shri Shikshayatan College, Kolkata, India)

E-mail: barnali.laha87@gmail.com

Abstract: The aim of the present paper is to prove some results on the properties of LP-Sasakian manifolds under D-homothetic deformations. In the later sections we give several results on some properties which are conformal under the mentioned deformations. Lastly, we illustrate the main theorem by giving a detailed example.

Key Words: D-homothetic deformation, LP-Sasakian manifold, ϕ -section, sectional curvature.

AMS(2010): 53C15, 53C25.

§1. Introduction

The notion of Lorentzian almost para-contact manifolds was introduced by K. Matsumoto [3]. Later on, a large number of geometers studied Lorentzian almost para-contact manifold and their different classes, viz., Lorentzian para-Sasakian manifolds and Lorentzian special para-Sasakian manifolds [4], [5], [6], [7]. In brief, Lorentzian para-Sasakian manifolds are called LP-Sasakian manifolds. The study of LP-Sasakian manifolds has vast applications in the theory of relativity.

In an n -dimensional differentiable manifold M , (ϕ, ξ, η) is said to be an almost paracontact structure if it admits a $(1, 1)$ tensor field ϕ , a timelike contravariant vector field ξ and a 1-form η which satisfy the relations:

$$\eta(\xi) = -1, \quad (1.1)$$

$$\phi^2 X = X + \eta(X)\xi, \quad (1.2)$$

for any vector field X on M . In an n -dimensional almost paracontact manifold with structure (ϕ, ξ, η) , the following conditions hold:

$$\phi\xi = 0, \quad (1.3)$$

$$\eta \circ \phi = 0, \quad (1.4)$$

$$\text{rank } \phi = n - 1. \quad (1.5)$$

Let M^n be differentiable manifold with an almost paracontact structure (ϕ, ξ, η) . If there exists a Lorentzian metric which makes ξ a timelike unit vector field, then there exists a

¹Received September 11, 2018, Accepted May 24, 2019.

tensor as follows:

$$\begin{aligned} R(e_1, e_2)e_2 &= 3e_1, \quad R(e_1, e_2)e_1 = 3e_2, \quad R(e_2, e_3)e_3 = -e_2, \\ R(e_1, e_3)e_2 &= 0, \quad R(e_1, e_3)e_1 = -e_3, \quad R(e_2, e_3)e_2 = e_3, \\ R(e_1, e_2)e_3 &= 0. \end{aligned}$$

In equation (3.22) we put $X = e_1, Y = \phi e_1, Z = e_1$. Taking inner product with ϕe_1 we obtain

$$a\overline{K}(e_1, \phi e_1) - K(e_1, \phi e_1) = a - \frac{1}{a}.$$

Hence, by this example Theorem 3.4 is verified.

References

- [1] A. Sarkar, M.Sen, On invariant submanifolds of LP-Sasakian manifold, *Extracta Mathematicae*, Vol.27, No.1(2012), 145-154.
- [2] D.E. Blair, Contact manifolds in Riemannian geometry, *Lecture Notes in Mathematics*, Vol.509, Springer Verlag, Berlin, 1976.
- [3] K. Matsumoto, On Lorentzian paracontact manifolds, *Bull. of Yamagata Univ. Nat. Sci.*, 12(1989), 151-156.
- [4] K. Matsumoto, I. Mihai, On a certain transformation in a Lorentzian para-Sasakian manifold, *Tensor (N.S.)*, 47 (2) (1988), 189-197.
- [5] K. Matsumoto, I. Mihai, R. Rosca, ξ -null geodesic gradient vector fields on a Lorentzian para-Sasakian manifold, *J. Korean Math. Soc.*, 32 (1) (1995), 17-31.
- [6] I. Mihai, R. Rosca, *On Lorentzian P-Sasakian Manifolds in Classical Analysis*, (Kazimierz Dolny, 1991, Tomasz Mazur, Ed.), World Scientific Publ. Co., Inc., River Edge, NJ, 1992, 155-169.
- [7] G.P. Pokhariyal, Curvature tensors in Lorentzian para-Sasakian manifold, *Quaestiones Math.*, 19 (1-2) (1996), 129-136.
- [8] S.Tanno, The topology of contact Riemannian manifolds, *Tohoku Math. J.*, 12(1968), 700-717.
- [9] U.C. De, A.A.Shaikh, *Complex Manifolds and Contact Manifolds*, Narosa Publishing House Private Limited, 2009.
- [10] D. Narain, S. K. Yadav, S. K. Dubey, On projective ϕ -recurrent Lorentzian para-Sasakian manifolds, *Global Journal of Mathematical Sciences : Theory and Practical*, Vol. 2, No.1 (2010), 265-270.



Contents

Computing Zagreb Polynomials of Generalized xyz -Point-Line Transformation Graphs $T^{xyz}(G)$ With $z = -$ By B. Basavanagoud and Anand P. Barangi 01

On (j, m) Symmetric Convex Harmonic Functions
By Renuka Devi K, Hamid Shamsan and S. Latha 15

On M-Projective Curvature Tensor of a $(LCS)_n$ -Manifold
By Divyashree G. and Venkatesha 23

D-homothetic Deformations of Lorentzian Para-Sasakian Manifold
By Barnali Laha 34

Position Vectors of the Curves in Affine 3-Space According to Special Affine Frames By Yılmaz TUNÇER 43

A Generalization of Some Integral Inequalities for Multiplicatively P-Functions
By Huriye Kadakal 60

C-Geometric Mean Labeling of Some Cycle Related Graphs
By A.Durai Baskar and S.Arockiaraj 69

Neighbourhood V_1 -Magic Labeling of Some Shadow Graphs
By Vineesh K.P. and Anil Kumar V. 86

Open Packing Number of Triangular Snakes
By S.K.Vaidya and A.D.Parmar 99

Second Status Connectivity Indices and its Coindices of Composite Graphs
By K.Pattabiraman and A.Santhakumar 104

A Note on Detour Radial Signed Graphs
By K. V. Madhusudhan and S. Vijay 114

A Note on 3-Remainder Cordial Labeling Graphs
By R.Ponraj, K.Annathurai and R.Kala 119

An International Journal on Mathematical Combinatorics

