Dumlupınar Üniversitesi Fen Bilimleri Enstitüsü Dergisi
Sayı : 13 Haziran 2007 1302 - 3055

ON DIFFERENTIAL GEOMETRY OF THE LORENTZ SURFACES

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Abstract

In this paper we have defined the sign functions ε_1, ε_2, ε_3, ε_4, ε_5 and the vector fields X_u, X_v, n_u and n_v which have taken derivatives with (u,v) parameters of the tangent vector field X of any surface in Lorentz space and we get fundamental forms, Weingarten equations, Olin-Rodrigues and Gauss formulae. Beside these we calculate Gauss and mean curvatures.

***Keywords:** Lorenz Surface, Fundamental Forms, Curvatures, Weingarten Formulae*

Preliminaries

It is well known that in a Lorentzian Manifold we can find three types of submanifolds: Space-like (or Riemannian), time-like (Lorentzian) and light-like (degenerate or null), depending on the induced metric in the tangent vector space. Lorentz surfaces has been examined in numerous articles and books. In this article, however, we have examined some characteristics belonging to the surface by making some special choices on tangent space along the coordinate curves of the surface. Let IR^3 be endowed with the pseudoscalar product of *X* and *Y* is defined by

$$\langle X, Y\rangle = x_1y_1 + x_2y_2 - x_3y_3 \qquad X = (x_1, x_2, x_3),\ Y = (y_1, y_2, y_3)$$

$(IR^3, \langle , \rangle)$ is called 3-dimensional Lorentzian space denoted by L^3 [1]. The Lorentzian vector product is defined by

$$X \times Y = \begin{vmatrix} e_1 & e_2 & -e_3 \\ x_1 & x_2 & x_3 \\ y_1 & y_2 & y_3 \end{vmatrix}$$

A vector fields X in L^3 is called a space-like, light-like, time-like vector field if $\langle X,X\rangle > 0$, $\langle X, X\rangle = 0$ $\langle X,X\rangle < 0$ accordingly. For $X \in L^3$, the norm of X defined by

$$\|X\| = \sqrt{|\langle X, X\rangle|}$$

and X is called a unit vector if $\|X\| = 1$ [2].