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The Second Laplace-Beltrami Operator on Rotational Hypersurfaces in the Euclidean 4-Space

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Abstract

We consider rotational hypersurface in the four dimensional Euclidean space. We calculate the mean curvature and the Gaussian curvature, and some relations of the rotational hypersurface. Moreover, we define the second Laplace-Beltrami operator and apply it to the rotational hypersurface.

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1 Introduction

The notion of finite type immersion of submanifolds of a Euclidean space has been used in classifying and characterizing well known Riemannian submanifolds [4]. Chen [4] posed the problem of classifying the finite type surfaces in the 3-dimensional Euclidean space E^3. A Euclidean submanifold is said to be of Chen finite type if its coordinate functions are a finite sum of eigenfunctions of its Laplacian Δ. Further, the notion of finite type can be extended to any smooth function on a submanifold of a Euclidean space or a pseudo-Euclidean space. Then the theory of submanifolds of finite type has been studied by many geometers.

Takahashi [22] states that minimal surfaces and spheres are the only surfaces in E^3 satisfying the condition $\Delta r = \lambda r$, $\lambda \in R$. Ferrandez, Garay and Lucas [10] prove that the surfaces of E^3 satisfying $\Delta H = AH$, $A \in Mat(3,3)$ are either minimal, or an open piece of sphere or of a right circular cylinder.