International Electronic Journal of Geometry
Volume 7 No. 1 pp. 154–162 (2014) ©IEJG

A NEW KIND OF HELICOIDAL SURFACE OF VALUE M

ERHAN GÜLER

Dedicated to memory of Professor Franki Dillen

Abstract. We define a new kind of helicoidal surface of value m. A rotational surface which is isometric to the helicoidal surface of value m is revealed. In addition, we calculate some differential geometric properties of the helicoidal surface of value 3 in three dimensional Euclidean space.

1. Introduction.

In classical surface geometry, the right helicoid (resp. catenoid) is the only ruled (resp. rotational) surface which is minimal in Euclidean space. If we focus on the ruled (helicoid) and rotational characters, we have Bour's theorem in [4]. The French Mathematician Edmond Bour used semi-geodesic coordinates and found a number of new cases of the deformation of surfaces in 1862. He also gave a well known theorem about the helicoidal and rotational surfaces.

Kenmotsu, [14] focuses on the surfaces of revolution with prescribed mean curvature. About helicoidal surfaces in Euclidean 3-space, do Carmo and Dajczer [5] prove that, by using a result of Bour [4], there exists a two-parameter family of helicoidal surfaces isometric to a given helicoidal surface. By making use of this parametrization, they found a representation formula for helicoidal surfaces with constant mean curvature. Furthermore they prove that the associated family of Delaunay surfaces is made up by helicoidal surfaces of constant mean curvature. Hitt and Roussos [11] also study on the helicoidal surfaces with constant mean curvature using computer graphics. Baikoussis and Koufogiorgos [1] prove that the helicoidal surfaces satisfying $K_{II} = H$ are locally characterized by the constancy of the ratio of the principal curvatures. Ikawa determines pairs of surfaces by Bour's theorem with the additional condition that they have the same Gauss map in Euclidean 3-space in [12]. Some relations among the Laplace-Beltrami operator and curvatures of the helicoidal surfaces in Euclidean 3-space are shown by Güler et al in [9]. They give Bour's theorem on the Gauss map, and some special examples.

On the other hand, Dillen and Sodsiri [6] study ruled linear Weingarten surfaces in Minkowski 3-space. See also Minkowskian cases in ([2, 3, 8, 9, 13]).

2010 *Mathematics Subject Classification.* Primary 53C50; Secondary 53C40.
Key words and phrases. Helicoidal surface of value m, rotational surface of value m, mean curvature, Gaussian curvature, Gauss map.