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Classification of Non-normal Quartic Surfaces

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Introduction

Recently I am interested in quartic surfaces in P^3, because I believe that there is a simple law explaining how singularities appear on quartic surfaces. Even though I have found out a law described by Dynkin graphs for a restricted class of quartic surfaces, it is very important to find out the general law. (Urabe [30], [31], Umezu-Urabe [29]). For this purpose it is necessary to study what kinds of singularities appear on non-normal quartic surfaces, as one step.

In this article we give the classification of non-normal quartic surfaces (i.e., surfaces of degree 4 with 1-dimensional singular loci) in the three dimensional projective space P^3 over the complex number field C.

Note that we can assume without loss of generality that the surface is reduced and irreducible because otherwise by considering its components we can reduce the problem to the case where degree is 1, 2 or 3. Classification of linear and quadratic surfaces is trivial and classification of cubic surfaces was given in Bruce-Wall [4].

We have many classical papers and modern ones treating this subject. (Clebsch [5], Jessop [12], Klein [16], [17], Kummer [18], Nöther [19], Rohn [21], Segre [23]; Kato-Naruki [14], [15], Shah [24], Takahashi-Watanabe-Higuchi [26], Umezu [27], [28] etc.) For example, Jessop [12] was published in 1916, which treats quartic surfaces which are not ruled surfaces. We can find in it explanation of surfaces corresponding to the items (III-A-1), (III-B), and (III-C) in the next section. But it is not clear whether they knew that there are no other non-normal quartic surfaces than those in this article or not. Therefore in order to find out the law it is not enough. Moreover it is important to give a description from the modern view-point, because we can now use powerful tools developped during the 20-th century such as sheaf theory, cohomology theory, etc. It seems

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