# EQUISINGULAR STRATA OF SINGULAR K3-SURFACES

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| **ABSTRACT**  K3-surfaces occupy a very special niche in algebraic geometry: they are sophisticated enough to pose interesting problems, and they provide adequate tools for solving these problems. We are interested in the geometry of smooth rational curves and finite group actions on K3-surfaces. In this study we show that, using the global Torelli theorem and surjectivity of the period map, any reasonable question about a K3-surface can be restated in terms of its Néron-Severi lattice, and the corresponding arithmetical problem can be solved by means of Nikulin’s theory of discriminant forms, extended by Miranda and Morrison.  A projective model of a K3-surface X gives rise to a *polarization*, i.e., class h of the hyperplane section. Irreducible smooth rational curves on X are (some) classes l of square (-2) intersecting h in a prescribed way. The simplest case is that of *exceptional divisors*, where we deal with the equisingular deformation classification of singular models. The case of plane sextic curves (degree 2) was closed by Akyol and Degtyarev [1], after numerous fruitless attempts to settle it by the conventional, equation based methods. This study was based on the previous work by Degtyarev [3], Shimada [5], Urabe [6], Yang [7] and others. The case of spatial quartics (degree 4) was treated conventionally by Degtyarev [2] in the presence of a non-simple singularity. The K3-theoretic approach, also pioneered by Urabe and Yang and used by Güneş Aktaş [4] to complete the classification in the non-special case, has been intensively discussed in this project.  **References:**  [1] Akyol, A., Degtyarev, A. (2015). Geography of irreducible plane sextics. *Proc. Lond. Math. Soc. (3)*, 111(6), 1307–1337.  [2] Degtyarev, A. (1989). Classification of quartic surfaces that have a nonsimple singular point. *Izv. Akad. Nauk SSSR Ser. Mat.*, 53(6), 1269–1290  [3] Degtyarev, A. (2008). On deformations of singular plane sextics. *J. Algebraic Geom.*, 17(1), 101–135.  [4] Günes ̧ Aktas, Ç. (2017). Classification of simple quartics up to equisingular deformation. *Hiroshima Math. J.*, 47(1), 87–112.  [5] Shimada, I. (2018). Connected components of the moduli of elliptic K3 surfaces. *Michigan Math. J.*, 67(3), 511–559.  [6] Urabe, T. (1990). Tie transformations of Dynkin graphs and singularities on quartic surfaces. *Invent. Math.*, 100(1), 207–230.  [7] Yang, J.-G. Enumeration of combinations of rational double points on quartic surfaces. Singularities and complex geometry, Beijing, 1994, volume 5 of AMS/IP Stud. Adv. Math., 275–312. |

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