Mathematics > Algebraic Geometry

Configuration types and cubic surfaces

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This paper is a sequel to the paper \cite{refGH}. We relate the matroid notion of a combinatorial geometry to a generalization which we call a configuration type. Configuration types arise when one classifies the Hilbert functions and graded Betti numbers for fat point subschemes supported at $n\le8$ essentially distinct points of the projective plane. Each type gives rise to a surface X obtained by blowing up the points. We classify those types such that $n=6$ and $-K_X$ is nef. The surfaces obtained are precisely the desingularizations of the normal cubic surfaces. By classifying configuration types we recover in all characteristics the classification of normal cubic surfaces, which is well-known in characteristic 0 \cite{refBW}. As an application of our classification of configuration types, we obtain a numerical procedure for determining the Hilbert function and graded Betti numbers for the ideal of any fat point subscheme $Z=m_1p_1+...+m_6p_6$ such that the points p_i are essentially distinct and $-K_X$ is nef, given only the configuration type of the points $p_1,...,p_6$ and the coefficients m_i.

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