Smooth double covers of K3 surfaces

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Abstract. In this paper we classify the topological invariants of the possible branch loci of a smooth double cover $f : X \to Y$ of a K3 surface Y. We describe some geometric properties of X which depend on the properties of the branch locus. We give explicit examples of surfaces X with Kodaira dimension 1 and 2 obtained as double cover of K3 surfaces and we describe some of them as bidouble cover of rational surfaces. Then, we classify the K3 surfaces which admit smooth double covers X satisfying certain conditions; under these conditions the surface X is of general type, $h^{1,0}(X) = 0$ and $h^{2,0}(X) = 2$. We discuss the variation of the Hodge structure of $H^2(X, \mathbb{Z})$ for some of these surfaces X.