

## Determinant morphism for singular varieties

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**Abstract.** Let  $X$  be a (possibly singular) projective variety over an algebraically closed field of any characteristic and let  $\mathcal{F}$  be a coherent sheaf on  $X$ . In this article, we define the determinant of  $\mathcal{F}$  in such a way that it agrees with the classical definition of determinant in the case where  $X$  is nonsingular. We study how the Hilbert polynomial of the determinant varies in families of singular varieties. Consider a singular family such that every fiber is a normal, projective variety. Unlike in the case where the family is smooth, the Hilbert polynomial of the determinant does not remain constant on such a family. However, we show that it exhibits an upper semi-continuous behaviour. Using this we give a determinant morphism defined over flat families of coherent sheaves. This morphism coincides with the classical determinant morphism in the smooth case. Finally, we give applications of our results to moduli spaces of semi-stable sheaves on  $X$  and to Hilbert schemes of curves.

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