An Explicit Characterization of Factorization of a Large Class of Multivariate Polynomials in terms of Absolutely Irreduble Factors over Finite Fields

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One of the key problems in algebraic geometry and its applications in coding theory, cryptography and other disciplines is to determine whether the variety defined by a set of polynomials is absolutely irreducible, i.e., it remains irreducible in the algebraic closure of the defining field. One important place one needs this is when one wants to apply the Riemann-Roch theorem. Another important case in the Weil conjectures and their applications to find bounds on the number of rational points and also bounds on exponential sums. In our case, we consider the hypersurfaces defined by a multivariate polynomial. The famous Eisenstein criterion for irreducibility works only over the defining fields.
There are only a handful of criteria for absolute irreducibility known so far. In this presentation, we will present a bound on the number of absolutely irreducible factors of an infinite family of multivariate polynomials. We will show how this result can be used to guarantee that a polynomial is absolutely irreducible. We will also present an algorithm based on our criterion.

Keywords: multivariate polynomial, factorization, number of factors, absolutely irreducible polynomials, hypersurfaces, finite fields, algebraic geometric codes.