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Stable binomials over finite fields

We study stable binomials over finite fields, that is, irreducible binomials $x^t - b \in \mathbb{F}_q[x]$ such that all their iterates are also irreducible over \mathbb{F}_q . We obtain a simple criterion on the stability of binomials based on the forward orbit of 0 under the map $z \mapsto z^t - b$. In particular, our criterion extends the one obtained by Jones and Boston (2011) for the quadratic case. As applications of our main result, we obtain an explicit 1-parameter family of stable quartics over prime fields \mathbb{F}_p with $p \equiv 5 \pmod{24}$, and also develop an algorithm to test the stability of binomials over finite fields. Finally, building upon a result of Ostafe and Shparlinski (2010), we employ character sums to bound the complexity of such algorithm.

Joint work with Arthur Fernandes and Lucas Reis (Universidade Federal de Minas Gerais, Brazil).