

# Some New Absolutely Irreducibility Testing Criteria and Their Applications to the Proof of A Conjecture on Exceptional Almost Perfect Nonlinear (E-APN) Function

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## Abstract

We give new absolute irreducible testing criteria for multivariate polynomials over finite fields, including guaranteeing the existence of an absolute irreducible factor over the defining field. As applications, we make substantial progress on proving the exceptional almost perfect nonlinear (APN) conjecture.

We generalize results by Delgado and Janwa to prove the Gold and Kasami Welch cases of the exceptional APN conjecture when the second term is of an odd degree. We make significant progress in the Gold case when the second term is of an even degree