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The functional graph of $f(X) = (cX^q + aX)(X^q - X)^{n-1}$ over quadratic extensions of finite fields

Let $\mathbb{F}_q$ be the finite field with q, where q is an odd prime power. In this presentation we describe completely the dynamics of the family of functions $f(X) = (cX^q + aX)(X^q - X)^{n-1}$, for $a, c \in \mathbb{F}_q$ and $n \geq 2$, over the finite field $\mathbb{F}_{q^2}$. We provide the number and size of its cycles as well as the behavior of the trees hanging from each periodic element.