

SEMINARIO

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Weight distribution of cyclic codes defined by quadratic forms and related curves

Abstract:

We consider cyclic codes $C_{\mathcal{L}}$ associated to quadratic trace forms in m variables $Q_R(x) = \text{tr}_{q^m/q}(xR(x))$ determined by a family \mathcal{L} of q -linearized polynomials R over \mathbb{F}_{q^m} , and three related codes $C_{\mathcal{L},0}$, $C_{\mathcal{L},1}$ and $C_{\mathcal{L},2}$. We describe the spectra for all these codes when \mathcal{L} is an even rank family, in terms of the distribution of ranks of the forms Q_R in the family \mathcal{L} , and we also compute the complete weight enumerator for $C_{\mathcal{L}}$. In particular, considering the family $\mathcal{L} = \langle x^{q^\ell} \rangle$, with ℓ fixed in \mathbb{N} , we give the weight distribution of four parametrized families of cyclic codes C_ℓ , $C_{\ell,0}$, $C_{\ell,1}$ and $C_{\ell,2}$ over \mathbb{F}_q with zeros $\{\alpha^{-(q^\ell+1)}\}$, $\{1, \alpha^{-(q^\ell+1)}\}$, $\{\alpha^{-1}, \alpha^{-(q^\ell+1)}\}$ and $\{1, \alpha^{-1}, \alpha^{-(q^\ell+1)}\}$ respectively, where $q = p^s$ with p prime, α is a generator of $\mathbb{F}_{q^m}^*$ and $m/(m, \ell)$ is even. Finally, we give simple necessary and sufficient conditions for Artin-Schreier curves $y^p - y = xR(x) + \beta x$, p prime, associated to polynomials $R \in \mathcal{L}$ to be optimal. We then obtain several maximal and minimal such curves in the case $\mathcal{L} = \langle x^{p^\ell} \rangle$ and $\mathcal{L} = \langle x^{p^\ell}, x^{p^{3\ell}} \rangle$.

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