Linear and polycyclic codes over some affine algebra rings*

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Abstract

In this talk, we will consider codes defined over an affine algebra $\mathcal{A} = R[x_1, \ldots, x_s]/\langle t_1(x_1), \ldots, t_s(x_s)\rangle$, where R is a chain ring and each $t_i(x_i)$ in $R[x_i]$ for $i \in \{1, \ldots, s\}$ is a monic polynomial. Namely, we will study the $\mathcal{A}$-submodules of $\mathcal{A}^\ell$, $\ell \in \mathbb{N}$. These codes generalize both the codes over finite quotients of polynomial rings and the multivariable codes over finite chain rings. A canonical generator matrix for these codes will be introduced with the help of the Canonical Generating System. Duality of the codes is also considered. The main tool will be a canonical generator matrix for these codes which is introduced with the help of the Canonical Generating System. We will end the talk reviewing the algebraic structure of polycyclic codes over $\mathcal{A}$ (that generalize cyclic and constacyclic codes), when each $t_i(x_i)$ in $R[x_i]$ is also square-free polynomial. We define quasi-s-dimensional polycyclic codes and establish an R-isomorphism between these codes and polycyclic codes over $\mathcal{A}$. We provide necessary and sufficient conditions for the existence of annihilator self-dual, annihilator self-orthogonal, annihilator linear complementary dual, and annihilator dual-containing polycyclic codes on this class of rings. The main references of this talk are [1, 2] and the references therein.

Vita

Edgar Martínez-Moro received the B. Sc. and M. Sc. degree in mathematics at University of Valladolid (Spain) in 1995 and 1997 respectively. He awarded

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his Ph.D. in Science in 2001 also at University of Valladolid. He was the Vernon Wilson Endowed Chair at the Department of Mathematics and Statistics at Eastern Kentucky University (2013) and currently he is Associate Professor at the Institute of Mathematics at University of Valladolid (Spain). His research interests include subjects related to algebraic coding theory, algebraic geometry, polynomial codes over rings, gradient descent like decoding methods, minimal codewords in codes and post quantum cryptography related to hard coding problems. This talk is part of his main current focus in polynomial algebra over rings and its applications to coding theory together with his colleague Maryam Bajalan, Institute of Mathematics and Informatics Bulgarian Academy of Sciences.

References

[1] E. Martínez-Moro, A. Piñera-Nicolás, I.F. Rúa, *Codes over affine algebras with a finite commutative chain coefficient ring*, Finite Fields and Their Applications, Volume 49, (2018), Pages 94-107, `https://doi.org/10.1016/j.ffa.2017.09.008`

[2] Maryam Bajalan, Edgar Martínez-Moro. *Polycyclic codes over serial rings and their annihilator CSS construction*, (2024) Arxiv 2404.10452, `https://arxiv.org/abs/2404.10452`.