CONGRESO DE JÓVENES INVESTIGADORES
Real Sociedad Matemática Española
Universidad de Murcia, del 7 al 11 de Septiembre de 2015

Linear and cyclic codes over direct product of chain rings

R. Ten-Valls[1], **J. Borges**[1], **C. Fernández-Córdoba**[1]

Linear codes are a special family of codes with rich mathematical structure. One of the most studied class of linear codes is the class of linear cyclic codes. The algebraic structure of cyclic codes makes easier their implementation. For this reason many practically important codes are cyclic.

The study of codes over rings has been growing since it was proven in [5] that certain notorious non-linear binary codes can be seen as binary images under the Gray map of linear codes over $\mathbb{Z}_4$. In particular, the family of codes over chain rings has received much attention (e.g. [6], [7]) because it includes some good codes.

In recent times, linear codes with sets of coordinates over different rings are studied (e.g. $\mathbb{Z}_2^\alpha \times \mathbb{Z}_4^\beta$ in [3], $\mathbb{Z}_{p^r}^\alpha \times \mathbb{Z}_{p^s}^\beta$ in [2]). Also, linear cyclic codes over these kind of structures are defined, see [1] and [4].

In this talk we present the structure of linear and cyclic codes over direct product of chain rings. We determine the generator matrix in standard form and the generator polynomials in the cyclic case. Finally, we present examples to illustrate some particular cases.

This work has been partially supported by the Spanish MEC grant TIN2013-40524-P and by the Catalan AGAUR grant 2014SGR-691.

Referencias

[1] T. Abualrub, I. Siap, N. Aydin: $\mathbb{Z}_2\mathbb{Z}_4$-additive cyclic codes, *IEEE Trans. Info. Theory* **60**(3) (2014), 1508–1514.

[2] I. Aydogdu, I. Siap: On $\mathbb{Z}_{p^r}\mathbb{Z}_{p^s}$-additive codes, *Linear and Multilinear Algebra*(2014) DOI: 10.1080/03081087.2014.952728 .

[3] J. Borges, C. Fernández-Córdoba, J. Pujol, J. Rifà and M. Villanueva: $\mathbb{Z}_2\mathbb{Z}_4$-linear codes: generator matrices and duality, *Designs, Codes and Cryptography* **54**(2) (2010), 167–179,.

[4] J. Borges, C. Fernández-Córdoba, R. Ten-Valls: $\mathbb{Z}_2$-double cyclic codes, *submited to IEEE Trans. Info. Theory.*(2014) arXiv:1406.4425.

[5] A.R. Hammons, P.V. Kumar, A.R. Calderbank, N.J.A. Sloane, P. Solé: The $\mathbb{Z}_4$-Linearity of Kerdock, Preparata, Goethals, and Related Codes, *IEEE Trans. Info. Theory* **40**(2) (1994), 301–319.

[6] H.Q. Dinh, S.R. López-Permouth: Cyclic and negacyclic codes over finite chain rings, *IEEE Trans. Info. Theory* **50**(8) (2004), 1728–1744.

[7] G. Norton, A. Salagean: On the structure of linear and cyclic codes over finite chain rings, *Appl. Algebra Eng. Commun. Comput.* **10**(6) (2000), 489–506.

[1]Department of Information and Communications Engineering
Universitat Autònoma de Barcelona
{joaquim.borges, cristina.fernandez, roger.ten}@uab.cat