Lifts of Self-Dual Codes

Suat Karadeniz[1], Refia Aksoy[2]

[1] *Department of Mathematics, Fatih University, İstanbul, Turkey*
[2] *Department of Mathematics, Fatih University, İstanbul, Turkey*
E-mail: refia06@gmail.com

Abstract: Self-dual codes have been studied quite extensively by coding theorists due to their rich algebraic structure. Self-dual codes over rings have drawn attention lately. After constructing a Gray map as a linear isometry from R_1^n onto $\mathbb{F}_2^{2n}$ in [1], some researchers generalized this map to R_k in [2] and [3]. With the help of the Gray map, self-dual codes over R_k were studied in [4]. In order to construct and classify extremal binary self-dual codes, some methods were developed. See [5], [6], [7], [8] for some of the works.

In this work, lifts of the binary self-dual codes to the ring R_k by using basic tools of linear algebra are described. By applying the method to the extremal binary self-dual $[14, 7, 4]$ code in the specific case of R_2, a family of self-dual codes over R_2 of length 14 are constructed. As Gray images of these codes $[56, 28, 10]$ binary self-dual codes are obtained. Ten extremal binary self-dual $[58, 29, 10]$ codes with new weight enumerators are found as extensions of these codes using the method given in [8]. Magma package has been used to construct these codes.

Keywords: Extremal codes, Gray map, Codes over rings, Self-dual codes, .

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