Abstract

The class of self-dual codes is an interesting topic in coding theory duo to their connections to other fields of mathematics such as Lattices, Cryptography, Invariant Theory, Block designs, etc. Let \mathbb{F}_{2^m} be a finite field of 2^m elements, and $R = \mathbb{F}_{2^m} [u]/\langle u^k \rangle = \mathbb{F}_{2^m} + u\mathbb{F}_{2^m} + ... + u^{k-1}\mathbb{F}_{2^m} (u^k = 0)$ where *k* is an integer and $k \ge 2$. For any odd positive integer *n*, an explicit representation for every self-dual cyclic code over *R* of length 2n and a mass formula to count the number of these codes are given. Moreover, a generator matrix for each self-dual and 2-quasi-cyclic code of length 4nover \mathbb{F}_{2^m} derived by a self-dual cyclic code of length 2n over $\mathbb{F}_{2^m+u}\mathbb{F}_{2^m}$ and a Gray map from $\mathbb{F}_{2^m+u}\mathbb{F}_{2^m}$ onto $\mathbb{F}_{2^m}^2$ is provided precisely. As an application, some good binary self-dual and 2-quasi-cyclic codes can be obtained.