Abstract (บทคัดย่อ)

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Project Title : Abelian and Quasi-Abelian Codes over Finite Rings
(ชื่อโครงการ) รหัสอาบีเลียนและรหัสควอซีอาบีเลียนบนริงจำกัด

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In this project, it is mainly focus on the characterization and enumeration of abelian and quasi-abelian codes over finite rings. Some related codes over finite fields and finite rings such as cyclic codes, constacyclic codes, quasi-twisted codes, self-dual codes and complementary dual codes are studied as well. Subsequently, some algebraic tools used in studying algebraic structured codes are developed. The results are summarized as follows.

Characterizations of Euclidean and Hermitian self-dual abelian codes a group ring $GR(p^r,s)[G]$ are given together with necessary and sufficient conditions for the existence of such codes in $GR(p^r,s)[G]$. In many cases, the formula for the number of such self-dual codes are established. The analog results for Euclidean and Hermitian self-dual cyclic codes over Galois rings are therefore obtained as corollaries.

An algorithm for factorizing $x^n-\lambda$ over F_{q^2} is given, where λ is a unit in F_{q^2}. Based on this factorization, the dimensions of the Hermitian hulls of λ-constacyclic codes of length n over F_{q^2} are determined. The characterization and enumeration of constacyclic Hermitian self-dual (resp., complementary dual) codes over F_{q^2} are given through their Hermitian hulls. The average dimension of the Hermitian hull of cyclic codes over F_{q^2} is determined together with some upper and lower bounds. Some results are extended to quasi-twisted codes which are a generalization of constacyclic codes. Necessary and sufficient conditions for quasi-twisted codes to be Hermitian self-dual are given. The enumeration of such self-dual codes is determined as well.

Alternative and explicit characterization and enumeration of such codes are given. An algorithm to find all 1-generator quasi-abelian codes is provided. Two 1-generator quasi-abelian codes whose minimum distances are improved from Grassl's online table are presented.

Two families of complementary codes over finite fields F_{q^2} are studied: i) Hermitian complementary dual linear codes, and ii) trace Hermitian complementary dual subfield linear codes. Necessary and sufficient conditions for a linear code (resp., a