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POLYNOMIAL RINGS AND FINITE FIELDS: APPLICATIONS TO CYCLIC CODES OVER SPECIAL RINGS

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ABSTRACT

This paper explores the algebraic properties of polynomial rings and finite fields, focusing on their applications to the construction and analysis of cyclic codes defined over special rings (such as finite chain rings and Galois rings). We analyze the algebraic structure of cyclic codes by identifying them as ideals in polynomial quotient rings, facilitating the determination of generator and parity-check polynomials. Furthermore, key properties including minimum distance, duality, and decoding algorithms are examined, highlighting the structural advantages offered by special rings compared to classical finite fields in coding theory and efficient data transmission.

Keywords: polynomial rings, finite fields, special rings, cyclic codes, generator polynomials, Galois rings, finite chain rings.

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