

ADVANCES IN ALGEBRAIC GEOMETRY: NOVEL APPROACHES TO ERROR CORRECTING CODES VIA ALGEBRAIC CURVES

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Received: 28 Aug 2024

Accepted: 01 Sep 2024

Published: 16 Sep 2024

ABSTRACT

Advances in algebraic geometry have paved the way for novel approaches to constructing and improving error-correcting codes, essential in digital communication and data storage. This paper explores the intersection of algebraic geometry and coding theory, focusing on the use of algebraic curves, particularly those over finite fields, to design efficient codes with enhanced error detection and correction capabilities. We delve into the theoretical underpinnings of algebraic-geometric codes, highlighting how properties of curves such as genus and rational points can be exploited to construct codes with better performance metrics than classical alternatives. Additionally, recent advancements in decoding algorithms and their practical implications for modern communication systems are discussed. The research presents a comprehensive review of existing methods while introducing innovative techniques to optimize code construction and error correction. The fusion of algebraic geometry and coding theory not only broadens the landscape of error-correcting codes but also offers promising directions for future research in secure and reliable data transmission.

KEYWORDS: Algebraic Geometry.