An Efficient Interpolation-Based Chase BCH Decoder

Abstract
BCH codes are adopted in many systems, such as flash memory, optical communications, and digital video broadcasting. By trying $2\eta$ test vectors, the soft-decision Chase decoding algorithm of BCH codes can achieve significant coding gain over hard-decision decoding. Previous one-pass Chase schemes find the error locators based on the Berlekamp’s algorithm and need hardware-demanding selection methods to decide which locator corresponds to the correct code word. In this brief, a novel interpolation-based one-pass Chase decoder is proposed for BCH codes. By making use of the binary property of BCH codes, an innovative yet low-complexity method is developed to select the interpolation output leading to successful decoding without bringing any performance loss. The code word recovery step is also significantly simplified through nontrivial mathematical derivations. From architectural analysis, the proposed decoder with $\eta = 4$ for a (4200, 4096) BCH code has 2.3 times higher efficiency in terms of throughput-over-area ratio than the prior one-pass Chase decoder based on the Berlekamp’s algorithm, while achieving the same error-correcting performance.

BCH (15,5) screenshots

Block diagram
RTL schematic
Design summary

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