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List Decoding of Crisscross Errors

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In this paper, list decoding of crisscross errors in arrays over finite fields is considered. For this purpose, the so-called cover metric is used, where the cover of a matrix is a set of rows and columns which contains all non-zero elements of the matrix. A Johnson-like upper bound on the maximum list size in the cover metric is derived, showing that the list of codewords has polynomial size up to a certain radius. Furthermore, a simple list decoding algorithm for a known optimal code construction is presented, which decodes errors in the cover metric up to our upper bound. These results reveal significant differences between the cover metric and the rank metric and show that the cover metric is more suitable for correcting crisscross errors.

Index Terms Cover metric, crisscross errors, Johnson bound, list decoding.

Generalized Integrated Interleaved Codes

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Generalized integrated interleaved codes refer to two-level ReedSolomon codes, such that each code of the nested layer belongs to different subcode of the first-layer code. In this paper, we first devise an efficient decoding algorithm by ignoring first-layer miscorrection and by intelligently reusing preceding results during each iteration of a decoding attempt. Neglecting first-layer miscorrection also enables to explicitly and neatly formulate the decoding failure probability. We next derive an erasure correcting algorithm for redundant arrays of independent disks systems. We further construct an algebraic systematic encoding algorithm, which had been open. Analogously, we propose a novel generalized integrated interleaving scheme over binary BoseChaudhuriHocquenghem codes, reveal a lower bound on the minimum distance, and derive a similar encoding and decoding algorithm as those of ReedSolomon codes.

Index Terms-Reed-Solomon codes, Bose-ChaudhuriHocquenghem (BCH) codes, integrated interleaving, generalized integrated interleaved codes, linear-feedbackshift-register (LFSR) encoding, syndrome decoding, erasure correcting, redundant arrays of independent disks (RAID).