ERROR CORRECTION CODING WITH CHARGE TRANSFER DEVICES

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ABSTRACT

New methods using charge transfer devices are proposed for economical implementation of digital multiple-error-correcting codes for reliable data communication. Digital non-binary cyclic codes are shown to be both efficient and amenable to practical implementation with charge coupled devices.

The charge coupled device (CCD), having large dynamic range combined with low-noise properties and moderate speed of operation, is suited particularly well for storage and transfer of multiple level digital data. The CCD lends itself most naturally to linear feedback shift register configurations and these are key structures in the efficient decoding of the cyclic algebraic codes popularly referred to as the BCH (Bose-Chaudhuri-Hocquenghem) codes. These codes, in generalized form, are known to have favorable properties for both random and burst error correction. They are perhaps the best known codes for this purpose.

Most, if not all, previous work in the practical implementation of the BCH codes has been concerned with codes whose symbols are either binary or are elements in a finite extension of the field of binary numbers. Appearance of the charge coupled device enables the removal of this restriction, and this is what is being attempted here. By exploiting the properties of the CCD it is possible to implement cyclic codes whose symbols are elements of a finite field, possibly an extension field, of characteristic p where p is a prime number > 2.

Properties of the generalized BCH codes are briefly described. Linear sequential circuit structures for the encoding and decoding operations are described. Alternative structures suitable for configuration with CCD's are identified and discussed. General results are specialized to the Reed-Solomon class of codes.

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FULL PAPER TO BE FOUND IN SECTION C

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