

A B S T R A C T

In this thesis we study error correcting codes with emphasis on variable length codes. This work provides new variable length error correcting codes which on the average will be better than those of constant length.

In Chapter 1, we introduce the study and give background material on variable length codes for noiseless channels including material on Shannon's entropy, and material on constant length error correcting codes with emphasis on combinatorial bounds and the class of perfect codes. We give also some definitions and concepts relating to variable length error correcting codes.

In Chapter 2, we derive some combinatorial results on variable length error correcting codes. Many of these results are for 'prompt' codes i.e. variable length, error correcting codes that can be decoded without delay. Two results reduce in appropriate situations to the Hamming sphere packing bound and the necessary part of the Kraft inequality. Another result reduced to the Gilbert bound and the sufficient part of the Kraft inequality.

In Chapter 3, we consider the aspect of code optimality for variable length error correcting codes. We first derive a lower bound on average length of prompt codes. This bound is in terms of a measure which is a generalization of Shannon's entropy. We show that it is always possible to make the average length as close as we like to this lower bound. Following this, we modify the celebrated Huffman construction to obtain a method of constructing optimal prompt codes.

In Chapters 4 and 5 we take up the study of perfect codes. First, in Chapter 4, we examine the constant length perfect codes in new geometric settings. We examine the codes in spaces of dimensions higher and lower than the space of the code. We use a cartesian inequation representation to achieve this. This leads to some new results including new 'perfect' codes which have non-uniform error correction capability.

In Chapter 5, using a combinatorial result of Chapter 2, we define and characterize 'variable length perfect codes'. We explore several aspects such as existence/non-existence questions and geometric interpretation.

The dissertation contains relevant references.