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The Generalized Omura Decoder.

It is well known that maximum-likelihood decoding on the binary symmetric channel can be reduced to finding a minimum-weight error vector whose syndrome is equal to that of the received vector. As observed by Omura, this task can be viewed as a minimization problem in which the objective function (the weight of the error vector) is computed in the real numbers while the constraints (the parity-check equations) are computed in the binary field. Using the simplex algorithm as a guide, Omura develops an iterative decoding algorithm that attempts to solve this minimization problem. While encouraging simulation results are presented, Omura does not give theoretical results on the performance of this decoder.

We present a generalization of Omura's iterative decoding algorithm that is capable of operating on any binary-input memoryless channel. Further, we show that the probability that the generalized Omura decoder outputs the maximum-likelihood codeword approaches 1 as the number of iterations goes to infinity. (Received January 22, 2010)