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Characterizing linear programming pseudocodewords using graphical methods.

The linear programming decoder, as defined by Feldman, is a relaxation of the maximum-likelihood integer program for binary linear codes. Central to the study of this decoder is its corresponding fundamental polytope, the feasible region over which the optimization takes place. The linear programming decoder is suboptimal when compared to maximum-likelihood decoding, and the loss in performance can be credited to the presence of non-integral extreme points (vertices) of the fundamental polytope, also referred to as linear programming pseudocodewords.

For the special class of cycle codes, we obtain a characterization of these fractional extreme points in terms of information taken from the associated Tanner graph. This characterization allows for easy identification and construction of pseudocodewords, and the techniques used in its proof may shed light on how to obtain a result for the general case. (Received September 21, 2009)