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Gallager's 1963 Bound: Extensions and Observations

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Abstract

New observations on Gallager's 1963 bound are presented here. This bound that was introduced in Gallager's work on low-density parity check codes, is a general bound for the decoding error probability of linear block codes transmitted through a binary-input symmetric-output memoryless channel and maximum likelihood (ML) decoded. The upper bounds derived here are of a particular interest for certain types of block codes and are also applied on turbo codes. These bounds were found to be efficient especially for high rate turbo codes with components that are binary linear systematic block codes and a uniform interleaver. However, their usefulness for rates above the cut-off rate and therefore their improvement over the union bound is demonstrated for a large variety of turbo codes.