

Variations on the Gallager Bounds, Connections and Applications

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ABSTRACT

In addressing the Gallager bounding techniques and their variations, we focus on the Duman and Salehi variation, which originates from the standard 1965 Gallager bound. The bounds in focus depend on the distance spectrum of the specific or ensemble of codes considered. By generalizing the framework of the second version of the Duman and Salehi bounds, we demonstrate its considerable generality and show that this variation provides the natural bridge between the 1961 and 1965 Gallager bounds. A large class of efficient recent bounds (or their Chernoff versions) is demonstrated to be a special case of the generalized second version of the Duman and Salehi bound. Implications and applications of these observations are pointed out, including the fully interleaved fading channel with decoding resorting to either matched or mismatched decoding. The proposed approach can be generalized to geometrically uniform non-binary codes, finite state channels and it can also be used for the derivation of upper bounds on the conditional decoding error probability.