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On improved bounds on the decoding error probability of block codes over interleaved fading channels, with application to turbo and low density parity check codes

Igal Sason and Shlomo Shamai (Shitz)

ABSTRACT

We study improved upper bounds on the decoding error probability of block codes operating over fully interleaved Rician fading channels. Assuming maximum likelihood decoding, the improved bounds proposed here are modified and generalized versions of some recently introduced bounds for the AWGN channel. The advantage of the improved upper bounds over the ubiquitous union bounds is demonstrated for some ensembles of turbo and low density parity check codes and it is especially pronounced in the rate region exceeding the cutoff rate. These generalized upper bounds favorably compete with an alternative bounding technique recently evaluated by Divsalar and Biglieri, and also with other reported bounds. A generalized upper bound derived here, which is based on the Duman and Salehi bounding technique, is demonstrated as the tightest reported bound. The upper bounds are also compared with computer simulations of efficiently and iteratively decoded turbo codes, demonstrating good match. Hence, the improved bounds here can also be used as a fast technique to approximately assess the performance of efficient iterative decoding. The upper bounds are also calculated for several orders of space diversity and in this case as well, they closely approximate the simulated performance of the iterative decoding.