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Designing Nonlinear Turbo Codes with a Target Ones Density

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Certain binary asymmetric channels, such as Z-channels in which one of the two crossover probabilities is zero, demand optimal ones densities different from 50%. Some broadcast channels, such as broadcast binary symmetric channels (BBSC) where each component channel is a binary symmetric channel, also require a non-uniform input distribution due to the superposition coding scheme, which is known to achieve the boundary of capacity region. This paper presents a systematic technique for designing nonlinear turbo codes that are able to support ones densities different from 50%. To demonstrate the effectiveness of our design technique, we design and simulate nonlinear turbo codes for the Z-channel and the BBSC. The best nonlinear turbo code is less than 0.02 bits from capacity.

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