On Fault-Tolerance of the Gallager B Decoder under Data-Dependent Gate Failures

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References:

Abstract:
In this letter we characterize the effect of data dependent gate failures on the performance of the Gallager B decoder of low density parity check codes. We show that this type of failures makes the decoder dependent on a transmitted codeword, thus rendering inapplicable the traditional analysis tools such as density evolution and trapping sets. By using Monte Carlo simulations, we identify two operating regions - one in which hardware unreliability leads to significant performance degradation, and one in which the performance loss is negligible. Based on these results, we propose a simple modification of the decoder that ensures its fault-tolerance.

Keywords:
fault-tolerance, data-dependence, Gallager B decoder, low-density parity-check codes, timing errors