

# Comparison of Belief Propagation and Iterative Threshold Decoding based on Dynamical Systems

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**Abstract:**

For a special class of convolutional codes, iterative threshold decoding (ITD) has been shown by simulations to achieve the same error rate performance as belief propagation (BP). In order to get a better understanding of these iterative decoding algorithms, we describe ITD and BP as discrete-time dynamical systems. Based on the theory of dynamical systems, we compare the dynamical behavior of ITD and BP. For the special case of a linear dynamical system, the behavior can be completely characterized. In this case we show that the fixed points of both ITD and BP are globally stable but they do not coincide. The analysis is extended to the case of a continuous-time dynamical system, which represents an important step for modeling analog iterative decoders.