Chair of Communications Engineering
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Master's Thesis

Protograph-based LDPC Code Design for Finite Number of Iterations

Low-density parity-check (LDPC) codes are usually designed using an extrinsic information transfer (EXIT) analysis to compute the asymptotic iterative decoding threshold for a given code ensemble. The iterative decoding threshold over an additive white Gaussian noise (AWGN) channel is thereby defined as the minimum signal-to-noise ratio (SNR) for which the a posteriori mutual information converges to one as the number of decoding iterations goes to infinity.

For practical applications, however, decoding is often performed using only a small number of iterations. Mulholland et al. investigated a code design for protograph-based LDPC codes where the protograph-based EXIT (PEXIT) analysis [1] is run for the targeted number of decoding iterations only [2]. They showed that for the binary erasure channel (BEC), the obtained iteration-constrained threshold does not match the bit error rate (BER) threshold of finite-length codes.

In this thesis, the student will understand and reproduce the results from [2], apply these tools to the AWGN channel, and compare them to code design tools developed at the institute.

[1] G. Liva and M. Chiani, “Protograph LDPC codes design based on EXIT analysis,” in Proc. IEEE Global Telecommun. Conf. (GLOBECOM), Nov. 2007, pp. 3250–3254.

[2] I. P. Mulholland, E. Paolini, and M. F. Flanagan, “Design of protograph-based LDPC code ensembles with fast convergence properties,” in Proc. Int. ITG Conf. Syst. Commun. Coding (SCC), Feb. 2017, pp. 1–6.

Prerequisites

- Channel codes for iterative decoding

Advisors

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