

Design of Quasi-Cyclic LDPC Codes for a Unified Coding Scheme

Bachelor's Thesis/Master's Thesis

Project

For the next-generation 6G wireless systems, rising demands for flexibility to adapt to different use cases, e.g., ultra-reliable and low latency communications (URLLC), are expected. This development also affects the channel coding scheme, yielding new expected design objectives, e.g., the latency and complexity of decoding. Thereby, unified coding is a candidate to become an enabling technology for a future 6G channel coding scheme. Herein, unified coding refers to a single code family that performs well in the different specified scenarios by, e.g., employing different decoders.

In particular, quasi-cyclic low-density parity-check (QC-LDPC) codes with belief propagation (BP) decoding have outstanding decoding performance for large block lengths. However, for future use cases, e.g., URLLC scenarios, short block length codes are unavoidable, a regime in which the BP decoding performance of QC-LDPC codes shows a significant gap to the performance of maximum likelihood (ML) decoding. Yet, BP-based decoding schemes provide different benefits, e.g., low latency and simple hardware implementation.

In this thesis, you should design a family of QC-LDPC codes with good decoding performances for different block lengths and rates. Furthermore, you should analyze the performance using different decoding schemes and infer novel design criteria.

Tasks

1. Design families of QC-LDPC codes for a future wireless system
2. Analyze performance using different decoding algorithms
3. Ideally: Propose novel decoding schemes

Requirements

- ✓ Interest in programming (Python, C++)
- ✓ Interest in communications and channel coding
- ✓ Interest in linear algebra

Institute

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