

Design of Quasi-Cyclic LDPC Codes for Unsourced Multiple-Access

Master's Thesis

Project

For future IoT scenarios, practical multiple access solutions, e.g., ALOHA, slotted ALOHA, and CDMA, become energy-inefficient due to the increasing number of users. However, most IoT devices are battery driven. Hence, energy is a valuable resource. In addition, IoT schemes result in new constraints, e.g., a small payload, a low fraction of active users at a given time, and channel access without any prior resource request. Therefore, new schemes for unsourced multiple access are mandatory. Thereby, suitable channel coding schemes yield outstanding theoretical performances. Thus, they are a promising candidate for future multiple-access solutions.

However, the design of suitable channel coding schemes is an open question. Quasi-cyclic low-density parity-check (QC-LDPC) codes are a prominent family of channel codes offering good decoding performances and benefits for hardware implementation. In particular, their quasi-cyclic structure makes them a contestant for multiple access scenarios with asynchrony.

In this thesis, you should design QC-LDPC codes for multiple access scenarios and propose a suitable decoding algorithm. Furthermore, you should implement the schemes and compare them to other existing approaches.

Tasks

1. Become familiar with channel coding for multiple access scenarios
2. Implement an environment to simulate multiple access scenarios
3. Design of suitable QC-LDPC codes together with a decoding algorithm

Requirements

- ✓ Programming experience or interest (e.g. Python, Matlab, C++)
- ✓ Interest in communications
- ✓ Recommended: Channel Coding: GBC

Institute

Communications Engineering Lab

Hertzstr. 16
Gebäude 06.45
76187 Karlsruhe
www.cel.kit.edu

Contact

M.Sc. Jonathan Mandelbaum

Room 204
jonathan.mandelbaum@kit.edu

M.Sc. Moritz Luca Schmid

Room -
moritz.schmid@kit.edu