Karlsruher Institut für Technologie

Communications Engineering Lab (CEL)
Prof. Dr.-Ing. Laurent Schmalen

Soft-aided Hard-decision Decoding for Staircase Codes

Bachelor's Thesis

Project

Staircase codes (SCCs) are powerful code constructions for high-speed optical fiber communications. Compared to conventional hard-decision decoding (HDD), the error-correcting performance of SCCs can be improved by using a Chase-Pyndiah based soft-decision decoding (SDD) algorithm. However, the power consumption can be an order of magnitude higher for SDD due to the large internal data flow. For very high throughput optical fiber systems with a data rate of 800 Gbit/s and beyond, a more energy-efficient decoding algorithm is of research interest.

Recently, there has been active research to improve the HDD performance of SCCs with a certain amount of soft information while keeping the computational complexity and internal data flow of the decoder manageable. The algorithms are known as soft-aided HDD algorithms. However, the performance is not yet optimal. In the past months, we have proposed a soft-aided decoding algorithm for product codes (PCs) providing a good performance-complexity trade-off. It is interesting to investigate whether such a decoder can be adapted to SCCs, given the resemblance between PCs and SCCs in terms of their code construction as well as the iterative decoding algorithm.

In this thesis, a soft-aided hard decision decoder for SCCs should be implemented. Furthermore, the parameters should be optimized and performance should be evaluated and benchmarked with the existing decoders. Ideally, the decoder should be improved taking the special structure of SCCs into consideration.

Deliverables

1. Become familiar with staircase codes and their iterative decoding algorithms.
2. Implementation and performance evaluation of a soft-aided hard decision decoder for staircase codes.
3. Investigation and development of novel decoding strategies for staircase codes.

Requirements

- ✓ Good programming skills (e.g. C++)
- ✓ Basic knowledge in channel coding (NT1)

Institute

Communications Engineering Lab

Hertzstr. 16
Gebäude 06.45
76187Karlsruhe
https://cel.kit.edu

Contact

Sisi Miao, M.Sc.

Room 209
sisi.miao@kit.edu