Karlsruhe Institute of Technology

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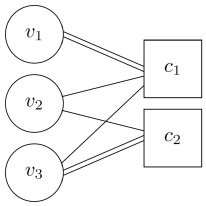
# Asymptotic Weight Enumerators for Type-Based Protograph LDPC Codes

**Master's Thesis**

## Project

Type-based protograph (TBP-) LDPC codes is a type of forward error correction (FEC) code that has been studied to optimise protograph LDPC codes for the very low SNR regime, i.e., for rates below 0.2. This regime is particularly interesting for continuous-variable quantum key distribution (CV-QKD).
In that low-rate regime, protograph LDPC codes tend to be quite rich in parameters, which leads to many degrees of freedom for the code optimization. For this purpose TBP-LDPC were introduced, as they nicely restrict the optimization space by fixing some parts of the code structure. As a result, TBP-LDPC codes are one of the most promising FEC codes for CV-QKD applications. Unfortunetely, usually quite high error floors can be observed with this type of code. The aim of this thesis is to model and characterize the asymptotic weight enumerators (AWE) of TBP-LDPC codes. With a suitable AWE description for TBP-LDPC codes, the aim will be to both optimize those codes for performance close to capacity, as well for achieving low error floors.

Protograph:




## Tasks

1. Learning how to calculate AWE for Protograph LDPC codes
2. Modelling the AWE for TBP-LDPC codes
3. Implementing a script to characterize the AWE of TBP-LDPC codes
4. Validating the Characterization by running simulations
5. Optionally, optimize TBP-LDPC codes for both decoding performance close to capacity and AWE

## Requirements

- ✔ Programming knowledge in Matlab, Python or C++
- ✔ Good unterstanding of basics in combinatorics
- ✔ Some knowledge on forward error correcting codes

## Institute

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