**Master Thesis**

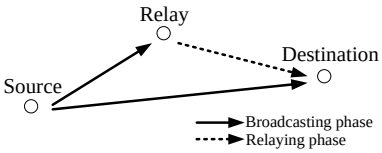
Chair for Theoretical Information Technology | RWTH AACHEN UNIVERSITY

# Design of Reliable Relaying Networks with Finite Blocklengths:
## Minimizing the Overall Error Probability

### Research Area
Wireless communication

### Keywords
Relaying, finite blocklengths, DF

### Description
In wireless communications, relaying is well known as an efficient way to mitigate wireless fading by exploiting spatial diversity. Specifically, two-hop decode-and-forward (DF) relaying protocols significantly improve the capacity and quality of service. However, most existing studies of the advantages of relaying are under the ideal assumption of communicating arbitrarily reliable at Shannon's channel capacity, i.e., coding is assumed to be performed using a block with an infinite length.



Two-hop relaying.

Under the finite blocklength regime, the error probability of the communication is no longer negligible. Recent works show that the error probability of a (non-relay) single-hop transmission is deceasing in the blocklength. Considering that two-hop relaying exploits spatial diversity and at the same time it halves the blocklength of the transmission (if equal time division is considered), the reliability of relaying under the finite blocklength regime becomes interesting. In our recent works, the capacity of relaying in the finite blocklength regime is studied. It is also interesting to design a relaying system while minimizing the overall error probability. For example, if the coding rate is given the overall error probability of relaying can be optimized by time and power allocation (for two hops) based on either perfect CSI or imperfect CSI.

### Goal
Our goal is to minimize the overall error probability of the two-hop DF relaying by symbols/time and power allocation.

### Requirements
- Strong interest in theoretical research.
- Background/knowledge in the filed of wireless communications and optimization.
- Expertise in mathematics.
- A solid foundation in MATLAB programming.

### Contact
Postdoctoral researcher **Yulin Hu**
Room 335, ICT cubes ✉ hu@umic.rwth-aachen.de ☎ +49 241 80 20743

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