Bachelor/Master Thesis

Chair for Theoretical Information Technology | RWTH AACHEN UNIVERSITY

A Comparative Study on Non-orthogonal Multiple Access for 5G Systems

Research Area: Wireless communications, multiple access schemes

Keywords: 5G, non-orthogonal multiple access schemes, physical layer

Description: Recent advances in multiple access schemes have produced a variety of approaches to coordinate access to shared media. To increase the performance and to meet QoS requirements of future wireless networks, some of these approaches compete for incorporation in future wireless standards, *e.g.*, 5G. Unlike classical schemes which use physical parameters like frequency and time, or characteristics of the channel, to coordinate access to a shared medium, modern schemes rely heavily on mathematical approaches. Most approaches are designed as non-orthogonal multiple access (NOMA) schemes.

The essential idea of NOMA is to serve multiple users with the same resource, such as spreading codes, time slots or non-orthogonal subcarriers. Several systems based on different schemes are already proposed and studied, such as power domain NOMA, sparse code multiple access (SCMA), bit division multiplexing, multi-user shared access (MUSA), interleave division multiple access (IDMA), lattice partition multiple access (LPMA), and pattern division multiple access (PDMA).

Goal: The goal of this thesis is a comparative study and performance evaluation of different NOMA systems under several scenarios. As a starting point, multiple access schemes, both classic and modern, shall be analysed. Identifying their key characteristics then offers a sound foundation for an in-depth discussion of modern NOMA schemes. To support the analysis, a review of the mathematical techniques involved will prove helpful.

Prerequisites:

- Fundamentals of wireless communication systems and multiple access schemes in particular.
- Strong interest in theoretical research.
- Solid knowledge about the mathematics of signals and systems.
- Strong mathematical background or willingness to acquire new tools.
- Programming in Python or MATLAB.

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