

Design of 5G NOMA Optimization Method and Algorithms (Internship)

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Starting time: Position available immediately

Context

The increasing demand of mobile Internet in 5G and future networks has posed a big challenge for the design of multiple access schemes. Non-orthogonal multiple access (NOMA) [1] is a promising technology. It enables better spectral efficiency, data rate and massive connectivity compared to orthogonal multiple access schemes (OMA) used in previous generations of cellular systems (1G-4G). Multiple access schemes adopted by 1G-4G cellular systems are all orthogonal in the sense that users are allocated orthogonal resources in frequency, time and/or code domains. These schemes aim to avoid or alleviate mutual interference among the users by dividing the radio resource into interference-free pieces. On the contrary, NOMA multiplexes several users on the same resource (e.g., frequency sub-carrier), thus achieving higher spectral efficiency in turn of larger decoding complexity. The basic principles of NOMA are signal superposition at the transmitter and successive interference cancellation (SIC) at the receiver. NOMA has attracted much attention for emerging 5G systems.

Objective

The aim of this project is to study constrained optimization problems in MC-NOMA systems, namely utility maximization by joint sub-carrier and power allocation optimization. The objective function to optimize can be the total data rate [2-3], proportional fairness [4] or max-min fairness utility. These problems are subject to some practical constraints based on power budget and SIC limitations. Most papers in the literature have focused on single-cell systems. Hence, the main goal would be to study the problems under multi-cell scenarios through the following tasks.

Tasks

- Problem analysis and formulation
- Design of optimization method and schemes
- New algorithm and performance simulations (e.g., using Matlab or Python)

References

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- [2] Y. Fu, L. Salaun, C. W. Sung, C. S. Chen and M. Coupechoux, "Double iterative waterfilling for sum rate maximization in multicarrier NOMA systems," *IEEE ICC*, 2017.
- [3] L. Salaun, C. S. Chen, and M. Coupechoux, "Optimal joint subcarrier and power allocation in NOMA is strongly NP-hard," *IEEE International Conference on Communications (ICC)*, 2018.
- [4] Q. Guo, C. W. Sung, Y. Chen, and C. S. Chen, "Power control for coordinated NOMA downlink with cell-edge users," *IEEE Wireless Communications and Networking Conference (WCNC)*, 2018.