

## **Analyzing Multiuser Access Schemes for a Gearbox-PHY**

Bachelor/Master/Diploma Thesis  
Studienarbeit/Diplomarbeit

### **Problem Statement**

Energy efficiency is becoming increasingly important for next-generation mobile networks due to environmental and economic pressures. Especially as the total data volume approximately increases by a factor 100 every 10 years, the energy per communicated bit needs to reduce significantly.

One promising solution is the Gearbox-PHY, which adaptively switches between modulation schemes and tailored radio front ends (called “gears”) to maximize energy efficiency while delivering required data rates. Here, high-order quadrature amplitude modulation (QAM) can be used for high data rate scenarios, while low-power alternatives like impulse radio are employed for lower data rate scenarios, significantly reducing front end power consumption.

This thesis will focus on analyzing how multi-user scenarios influence the energy saving potential of the Gearbox-PHY approach. For this the two main user separation approaches, i.e., time-division multiple access and frequency-division multiple access, should be compared in terms of their influence on the Gearbox-PHY energy consumption using an already existing optimization framework.

### **Tasks**

- Analyzing different user separation schemes in mobile networks
- Analyzing energy efficiency with given optimization framework

### **Expected Skills**

- Basic knowledge of communications
- Experience with MATLAB

### **Contact Person**

- Florian Gast ([florian.gast@tu-dresden.de](mailto:florian.gast@tu-dresden.de))

Please include a recent transcript of your grades when getting in contact

### **Recommended References**

- F. Gast, F. Roth, M. Dörpinghaus, P. Sen, S. Zeitz and G. Fettweis, “Energy Optimization using Joint Modulation Scheme and Front End Adaptation - the Gearbox-PHY,” in Proceedings of International Symposium on Wireless Communication Systems (ISWCS 2024), Rio de Janeiro, Brazil, Jul 2024. [Link](#)
- G. Fettweis and H. Boche, “6G: The Personal Tactile Internet - And Open Questions for Information Theory,” in IEEE BITS the Information Theory Magazin, vol. 1, no. 1, pp. 71-82, Aug 2021. DOI:10.1109/MBITS.2021.3118662. Show BibTeX.