Time-Aspects of Gear Switching in 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 sleep and idle modes can contribute to energy savings. The goal is to study different components of the analog receiver chain, examine their wake-up and synchronization times, and incorporate these insights into an already existing optimization framework. Lastly, the results of the optimization should be analyzed and used to identify promising implications for system design.

Tasks

- Researching wake up times of typical front end components
- Researching synchronization times of typical transceivers
- Analyzing energy efficiency with given optimization framework

Expected Skills

- Basic knowledge of communications
- Experience with MATLAB

Contact Person

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  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.