

Wireless Synchronisation of Distributed Antenna Systems Using Consensus Algorithms

Master Thesis

Background:

The proliferation of distributed, mobile, and satellite-based radio systems is creating new opportunities for cooperative signal processing, particularly in the domain of collaborative beamforming. The objective of this technology is to orchestrate multiple antenna units that are distributed over a wide area, ensuring that their combined signals are received coherently. This technology has the potential to offer several advantages, including enhanced range, increased data transmission speeds, and enhanced security against eavesdropping.

Conventional methods are frequently predicated on centralized control and synchronization architectures. This centralized approach encounters limitations when the number of network nodes increases, and furthermore, when individual nodes fail. A decentralized approach, exemplified by consensus-based algorithms, exhibits enhanced resilience to the failure of individual nodes and facilitates the coordination of a substantial number of nodes.

Task:

Within the scope of this master's thesis, approaches for decentralized coordination in distributed wireless networks are to be further developed, modelled and evaluated in realistic simulation scenarios. The initial focus will be on the implementation of a simulation environment in the Python programming language.

The simulation environment will be used to test various consensus-based algorithms in different scenarios. Finally, requirements for test hardware will be derived from the simulations in order to prepare a realization with test hardware.

Type of work:

30% framework programming, 30% implementation of consensus algorithms, 20% literature research, 20% simulation of various usage scenarios.

Your profile:

- Interest and basic knowledge in signal processing and antenna arrays
- Basic knowledge of EM wave propagation and antenna technology
- Good knowledge of Python programming



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