

Radar sensing in affine frequency-division multiplexing (AFDM)

Master's Thesis

Project

The currently dominating orthogonal frequency-division multiplexing (OFDM) waveform is suboptimal (unable to reach full channel diversity) in time-varying communication channels as encountered in, e.g., vehicle-to-X communication. Especially channels for joint communications and sensing can profit from the increased channel diversity that alternative waveforms can provide.

Affine Frequency Division Multiplexing (AFDM) is a candidate waveform that improves performance for such high-mobility scenarios. It has similarities to OFDM but is based on the affine Fourier transform. Since information is modulated onto chirps, we want to study the possible usage of these chirps for radar sensing.

Tasks

In this project, you will implement modulation and demodulation for AFDM. You will replicate its performance in a time-varying channel. Then with the aid of your system, you will study the received signal and evaluate methods to extract environmental information from the received signal. You will design a radar receiver suited to the AFDM signaling. Finally, your system will be compared to an OFDM RadCom (Radar Communications) system in order to quantify the advantages and disadvantages of AFDM.

Requirements

- ✓ Interest in alternative waveforms for digital communications
- ✓ Programming experience in Python
- ✓ Communications Engineering I & II
- ✓ Understanding of the basics of OFDM

Institute

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