Radar Communications for Combating Mutual Interference of FMCW Radars

Solved problem

如何在多个雷达的场景下，按照协议分配感知的带宽来防止彼此间的干扰 (Aim to resolving radar conflicts among vehicles with similar radar characteristics (same bandwidth and chirp signal) and focus on the radar interference reduction.)

Main idea

利用感知所未用到的带宽来进行通信,即划分出一部分频段来实现 carrier sense multiple access (CSMA) protocol，用于前后车间进行通信以实现感知频谱的资源分配（rTDMA，随机时分多址）. 本文提出了两个问题，但是主要研究第一个问题，第二个问题为future work(作者说采用频分复用FMD)

- 利用时分多址来协调不同雷达对感知频率的使用(Disseminate nonoverlapping rTDMA slots among radars to mitigate interference)
- 在雷达的idle时间内进行通信

Shortcoming

- They assume the vehicles perform us-level clock synchronization with GNSS (所能达到的精度为us-level?).
    - Guide to GPS/GNSS Clock synchroniztion, typical accuracy: 1us to a few milliseconds.
    - GPS Timing and Synchronization
    - 一种基于TD-LTE帧同步的电网时间同步方法
- 并未具体介绍如何实现雷达间的通信
- Only simulation of a two-vehicle scenario.

Target Detection in Joint Frequency Modulated Continuous Wave (FMCW) Radar-Communication System

Main idea

- Chirp-based M-ary FSK modulation: 改变每次chirp信号的初始频率来调制symbol（Δfm表示m-th symbol所对应的频偏）
- 本文是non-coherent receiver 没有考虑实际解调 ("The orthogonality of the chirp-M-FSK waveforms can be analyzed similar to the work in [10] and is out of the scope of this paper. Also, the theoretical bit-error-rate (BER) expressions for the non-coherent receiver above are yet to be explored in literature and also as our future work.")

Frequency Shift Chirp Modulation: The LoRa Modulation

- gives a regorous mathematical signal processing description of the modulation and demodulation process.
- Frequency Shift Chirp Modulation (FSCM): 不同symbol的chirp初始频率不同(?)

Poster: Multi-carrier Modulation on FMCW Radar for Joint Automotive Radar and Communication

- multi-carrier modulation: combine OFDM waveform with FMCW waveform
- Just formulation without any experiments or simulation
- shortcoming: without any solution about the dechirping synchronization schemes (just mention this as a future challenge)
    - Dechirping timing
    - Multi-path effect
    - FMCW chirp mismatch