

Recent Advances in Doppler Resilient Sequence Design and Applications

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Sequences with good correlation properties play a vital role in wireless communications, radar sensing, and cryptography. To estimate the range of a target from a radar based on the delay in the radar return, or to synchronize a mobile handset with a pilot signal sent from a base station, it is required to design sequences with impulse-like autocorrelation functions, such as Golay complementary sequences or zero correlation zone (ZCZ) sequences. Typically the estimation/synchronization is performed by matched filtering the received signal with the transmitted waveform, and the output of the matched filter would ideally be an impulse at the desired delay. However, the autocorrelation property of the Golay, ZCZ and other sequences is extremely sensitive to Doppler shift caused by the highly mobile target/handset. Although the effective ambiguity function of complementary sequences is free of delay (range) sidelobes along the zero-Doppler axis, it has large-range sidelobes off the zero-Doppler axis. In recent years, there are significant advances in Doppler resilient sequence design and applications. In this talk, the existing and new methods to construct Doppler resilient sequences based Golay and Z-complementary sequences will be discussed, together with the related applications in MIMO radar, cognitive radio and high mobility communications.