Performance Analysis of a Time-Domain Radar Waveform Designed for Optimal Target Detection

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Abstract

The problem of waveform design is becoming increasingly relevant and challenging to the modern state-of-the-art radar systems. With the recent technological advancements in the fields of flexible waveform generators and high-speed signal processing hardware, it is now possible to generate and transmit sophisticated radar waveforms that are optimally adapted to the sensing environments. In this talk, we present a direct time-domain waveform design approach that achieves optimal performance in detecting an extended target in the presence of signal-dependent interference. The direct time-domain approach allows straightforward characterizations of the autocorrelation and peak-to-average power ratio (PAPR) of the designed signals. Solving a bi-objective optimization problem that simultaneously optimizes the detection and autocorrelation performances, we synthesize both the constant- and varying-envelope waveforms. With extensive numerical examples we analyze the performances in terms of the detection, autocorrelation, and PAPR characteristics of the constant- and varying-envelope waveforms. We conclude the talk by discussing the optimal waveform design problem when the velocity of the target is unknown.

Biography

Satyabrata Sen is currently an R&D Associate in the Computer Science and Mathematics Division at Oak Ridge National Laboratory (ORNL). For the last two years till February 2013, he has been a recipient of the Eugene P. Wigner Fellowship at ORNL. He holds a Ph.D. in Electrical &Systems Engineering from Washington University in St. Louis, MO. His research interests are in the area of statistical signal processing, asynchronous distributed tracking, and their applications in radar, communications, and sensor arrays.