PRF Set Selection for Multistatic Radar

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Pulse Repetition Frequency (PRF) set selection for monostatic radar is governed by well-understood constraints including the velocities and ranges of targets of interest and the nature of the clutter in the scene. The design of a PRF schedule is specifically important when PRFs that are ambiguous in both range and velocity, or "medium" PRFs, are used. Numerous areas of monostatic radar performance are affected by the set selection, including determination of the true ranges and velocities of ambiguous targets, the incidence of ghosting due to correlation of ambiguous target returns with noise spikes, detectability at blind ranges due to transmitter eclipsing, and detectability at blind velocities due to mainbeam clutter suppression. Likewise, the PRF schedule of a bistatic radar system may be constrained by the existing design parameters of a monostatic system that is used as the transmitter for the bistatic system, and there may be little room for adjusting the set of PRFs for the needs of the supplementary bistatic receiver. Ongoing research in monostatic medium PRF set selection is dominated by the application of optimization techniques, including evolutionary algorithms, to determine optimal PRF schedules.

The constraints and methods for choosing PRF sets for multistatic radar systems are less understood. The multistatic system may include multiple transmitters, increasing both the flexibility and complexity of choosing PRF sets. Likewise, the geometric diversity of the transmitters and receivers results in range and velocity ambiguities that differ from the perspective of each bistatic transmitter/receiver combination; these ambiguities will change over time if the multistatic system contains airborne platforms. Angle information can be used to limit the impact of ghosting or range ambiguous targets, e.g., a target in the narrow antenna beams of a non-collocated transmitter and receiver can be determined to be in the range ambiguity associated with that spatial location, but if the angle information is of poor quality the multistatic geometry may not alleviate the need for disambiguation via the use of multiple PRFs.

This presentation outlines the constraints imposed on medium PRF set selection for multistatic radar systems with multiple transmitters and receivers under the assumption that precise angle information is not available. The presentation includes simulation results to illustrate the impact of various PRF schedules on regions of range and velocity ambiguous targets.