

Multistatic Polarimetric Radar Data Modeling

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Multistatic and polarimetric radars are two active areas of research. Polarimetric radar systems collect more information about an environment than if a single polarization is used, despite the historically prohibitive cost of these systems. Similarly, multistatic systems have a number of theoretical advantages, including 1) the ability to transmit multiple waveforms from collocated or distributed antennas, thus enabling interrogation of larger areas of interest due to the geometry of the system and 2) the possibility of augmenting fielded systems with additional low-power passive components. The design of a multistatic system, however, requires many decisions regarding the number, geometry, and polarization of the transmitters and receivers, and the waveforms that will be transmitted from each transmitter. These decisions will depend on the environment and targets of interest.

This presentation describes a data model and corresponding imaging operation for a multistatic polarimetric radar system with realistic antennas that may aid in the design of future systems. The mathematical model includes a) the process of radiation of an arbitrary waveform from a dipole antenna, b) the full vector case of electromagnetic wave propagation, c) polarimetric scattering from moving targets, and d) reception on a dipole antenna. A bistatic scattering matrix based on physical optics and accompanying shape function for a rectangular plate are considered. The physical significance of the analytical expressions is discussed.

The presentation also describes an imaging operation that weights and sums the filtered data collected at each receiver.

Simulations for various geometries and target scattering mechanisms are also included. These simulations make use of the imaging operation to visualize the results.