Modeling, Simulation and Transient Analysis of a Bistatic Impulse Radiating Antenna (IRA) Scene

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This paper shows the modeling, simulation results and transient analysis for a scattering scene consisting of a bistatic Impulse Radiating Antenna (IRA) pair and a sphere (scatterer) at the origin. The goal of this investigation is to examine the potential benefit of using modeling and simulation of an entire scattering scene, including the transmit (Tx) and the receive (Rx) sensors, to study the transient response of the scatterer. The investigation succeeded in yielding results that are consistent with the results of scattering from a sphere alone. The parameters of the scene, modeling, simulation and data processing are described in detail.

The scene basically consists of a transmit IRA located on the xy plane and a receive IRA located at a height above the transmitter. A sphere is located at the origin, at a distance above the plane and a distance away from the IRAs. The receive IRA is tilted down toward the scatterer at an angle pointing directly to the front and center point on the sphere. There is no ground plane in this initial investigation. The commercially available electromagnetic analysis software WIPL-D was used for the frequency domain simulation from 5MHz to 2GHz. The entire scene is efficiently modeled with just 3678 unknowns, and simulated in less than 27 hours for 400 frequencies. The scene is modeled with half-symmetry along the xz plane and Matlab is used to produce the transient response. The two figures below are from the WIPL-D preview pane and show the scene modeling.

Figure 1. The sphere scatterer and two sensors compose the modeled scene.

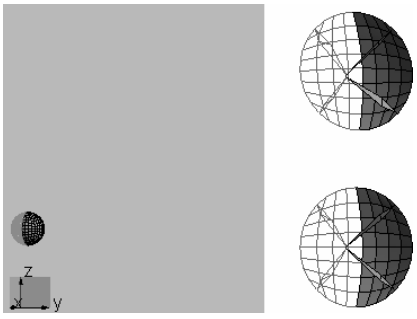

Figure 2. Half-symmetry (xz plane) is used to minimize the number of unknowns.