DECONVOLUTION OF A CONDUCTING SPHERE SCATTERER SIGNATURE USING A BISTATIC 6FT IRA SCENE SIMULATED IN WIPL-D

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ABSTRACT:

The impulse radiating antenna (IRA) has been designed, analyzed, built and tested by E. Farr, S Tyo and others in the years since it was first theorized by Carl Baum. In this paper, a 6ft diameter IRA is modeled and two of them are used in a bistatic configuration along with a 20 inch diameter conducting sphere scatterer. The bistatic scene is simulated in the frequency domain using the electromagnetic analysis code WIPL-D. Since the WIPL-D code uses entire domain basis functions over large subsectional patches it is possible to analyze electrically large antenna scattering scenes on a desktop computer utilizing modest computational resources. The greatest advantage of being able to simulate a practical antenna configuration using an electromagnetic analysis code is that the arrangement can be analyzed in a cost effective fashion using modest computational resources as opposed to using super computers and an elaborate measurement campaign which often becomes quite costly and time consuming. The objective of this document is to illustrate a process using deconvolution in the frequency domain to recover the time domain (and frequency domain) signature of the sphere scatterer from the simulated scene data. A system approach is used. First, in the time domain, the transmit and receive antenna contributions are decoupled and the late time pulse, due to the sphere scatterer, is isolated. Then, in the frequency domain, the individual transmit IRA and receive IRA signatures are deconvolved by division. The remaining response contains the combined signature of the input to the antenna and the scattering from the sphere. The input is a Gaussian pulse which behaves as a weighting on the frequency domain response of the scattering scene. This recovered response compares well with the simulated response of the sphere directly simulated with WIPL-D. In addition, a synthesis process convolving the simulated antennas, scatterer and input spectrums also shows good results, as expected. Numerical simulation results will be presented at the conference to illustrate the accuracy and efficiency of the proposed methodology. It will be demonstrated that numerical simulations can provide very accurate results representing the actual scene.