Multiplicatively Regularized Source Reconstruction Method for Phaseless Planar Near-Field Antenna Measurements

Trevor Brown
Dept. of Electrical & Computer Engineering
University of Manitoba
Trevor.Brown@umanitoba.ca

The source reconstruction method (SRM), as an antenna measurement technique, often operates on data collected in the near-field of the antenna under test (AUT) to reconstruct an equivalent current distribution of the AUT. In general, the SRM computes equivalent electric and magnetic currents on a virtual surface enclosing the AUT that radiate the same electromagnetic fields as the AUT. These currents can be used to compute the far-field pattern of the AUT, as well as provide valuable antenna diagnostic information. Most SRM research considers measured near-field data that has both amplitude and phase information, but an increasing trend towards antenna operation at higher frequencies makes collecting accurate phase information more challenging and expensive [1]. To this end, we investigate the application of the SRM to phaseless (amplitude-only) near-field measurement data.

In past applications of the SRM to phaseless near-field measurements, two planes of collected data were utilized to improve the accuracy of the reconstruction. One such method finds an equivalent magnetic current distribution by minimizing multiple cost-functionals that represent the misfit between the measured field amplitude and the field amplitude produced by the equivalent currents [2]. The method that we propose allows for simultaneous use of measurement data from two planes by employing a multiplicative regularization scheme similar to that originally developed for the inverse scattering problem [3]. The proposed method also supports the reconstruction of equivalent electric and magnetic currents, allowing for more complex reconstruction surface geometries.

Initially we will describe the mathematical formulation of the non-linear ill-posed inverse problem associated with the proposed phaseless SRM. We will then discuss the advantages of using a multiplicative regularization scheme and explain how the derivative-based conjugate gradient method is used to minimize the resulting non-linear cost-functional. Finally, we will give an overview of the numerical implementation of the proposed method for the case of planar near-field measurements, and present reconstruction results using synthetic near-field data, with and without additive noise.


ADVISORS: Dr. Puyan Mojabi and Dr. Ian Jeffrey

Proceedings of the 2015 Graduate Students Conference, GRADCON 2015
Winnipeg, MB, Canada; October 16, 2015
©Copyright retained by author and collaborators