Increased Efficiency of Integral Equation Solutions of Antennas by Incorporation of Network Principles

Adam W. Schreiber* and Chalmers M. Butler
Clemson University, Clemson, SC, 29634, http://www.ece.clemson.edu

Monopole and dipole antennas have been of interest for many years. More recently, attention has turned to accurate feed models for these antennas . Modeling the feed more accurately results in an increase in the cost of computing a solution in time, processing power and memory use. If the antenna were to be loaded, for instance with tuned cavities or ferrites, and optimised the additional cost is compounded at each step of the optimisation process. Thus, it is desired to increase the efficiency of the solution method.

A method is presented for increasing the efficiency of integral equation solutions for antennas. In this paper, a cylindrical monopole antenna fed by a radial guide which is driven by a coaxial guide is analysed. Expressions of the magnetic field in both the radial and coaxial guides are presented. An integral equation is formulated for the aperture electric field in the junction. Scattering parameters for the coaxial guide/radial guide junction are developed in terms of the aperture electric field to replace the solution of a coupled integral equation at the junction of the two guides. After the removal of the network, the remainder of the antenna is seen to be a radial-guide-fed monopole. An expression of the magnetic field in the radial feed is determined. A coupled integral equation is formulated and its reflection coefficient is determined at port 2 of the junction network. The reflection coefficient of the antenna feed is referred through the network to a measurement port. Computed reflection coefficient values are shown to agree reasonably well with values measured on laboratory models and a method of moments solution not involving networks.