Microstrip Reflectarrays with multi-layer grounded substrates and superstrates

Sembiam R. Rengarajan
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, CA 91109

Microstrip reflectarray antennas are becoming popular in many space applications because of their low profile and ease of deployment. An infinite uniformly spaced array of microstrip antennas consisting of identical elements and excited by a plane wave is the canonical problem of interest in the design and analysis of such antennas. The reflection coefficient obtained for the canonical problem is used as an approximation for the element reflection coefficient of a finite sized reflectarray if the element size or shape does not vary rapidly from element to element.

The infinite array of microstrip elements is usually analyzed by solving the pertinent integral equations for the induced currents in the microstrip elements. The required Green's functions appear as a Floquet series and their expressions are obtained in spectral domain by considering transmission line techniques for the TE and TM waves. The integral equations are solved by the method of moments. We have been investigating the moment method solutions for infinite arrays of different geometries such as microstrip patch arrays, crossed dipole arrays, arrays of stacked patches, and two-layer microstrip elements for dual frequency applications. In order to analyze a number of these problems we developed moment method solutions for microstrip elements with multiple layers of dielectric substrates and one or more layers of superstrates. The required Green's functions for the multi-layer problem are obtained in terms of the spectral domain TE and TM mode transmission matrices. Different choices of entire domain basis functions were studied. The reflection coefficients of infinite arrays excited by a normally incident plane wave were obtained by the finite element solver HFSS. These results compared well with our moment method results, thus validating our code.

In the symposium we will present the essential features of our moment method solutions. Numerical results for many of the structures will be presented.

Suggested Topic: Microstrip and printed antennas, phased array antennas
Session Organizer: John Huang

The research described in this paper was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration.