Name of the Ph.D. Research Scholar: Dhrubajyoti Bhattacharya
Roll No.: 13EC91R05

Abstract

This dissertation has been devoted to the full-wave Green's function analysis for the cylindrical and spherical stratified mediums.

An efficient technique is proposed for the removal of the spatial singularity for co-located source and field points in cylindrical multilayered media by decomposing the spectral domain Green's function into the particular and homogeneous parts. The particular part with the singularity is converted into the spatial domain using Sommerfeld identity while the discrete complex image method (DCIM) with general pencil of function (GPOF) technique is applied on the spectral domain homogeneous part. The use of the ratio form of the reflection / transmission matrices, the Debye approximation and the subsequent envelope extraction for the treatment of the spatial domain singularity is thus avoided. A very significant reduction in the number of modes required for convergence is achieved. The technique is applied for evaluating the input impedance of several antennas in the cylindrical multilayer structure. In addition, the general condition for obtaining the guided modes and the analysis of the radiation patterns of the cylindrical multilayer antenna configurations are also formulated.

An efficient procedure for computing the Green's function for an arbitrary directed point source radiating inside a spherically stratified media is presented. The Green's functions are provided in a ready-to-use form that can be applied without any modifications for the analysis of the spherical multilayer structure. The incorporation of a new source component or the addition of a new layer can be readily accommodated in the formulation without the recomputation of the Green's function unknowns. The matrix inversion step is also avoided in the computation of the unknowns of the Green's function. The source-free resonant frequency of the antenna modes can also be efficiently computed from the formulation. In addition, the singularity related to the spatial co-location of the field and source points is effectively treated in the formulation without asymptotic extraction. The technique is applied to the analysis of several spherical multilayer antenna configurations.

Finally, a circular waveguide annular slot coupled two-layer hemispherical dielectric resonator antenna (DRA) has been designed for broadband operation. Both cylindrical and spherical Green's function formulations are used in order to analyze this proposed antenna configuration.

Keywords: *– Cylindrical stratified medium, spherical stratified medium, Green's function, GPOF, monopole antenna, slot antenna, method of moments, input impedance*, *DRA.*