S U M M A R Y

The thesis presents investigations on some aspects of a rectangular coaxial line having infinitesimally thin inner conductor. The Green's function formulation, the conformal transformation and the finite-difference technique are used for the analysis.

Analysis based on the Green's function formulation which is applicable to both symmetric as well as asymmetric location of the inner conductor is used for the determination of the line capacitance, characteristic impedance and normalized field distribution. The results on line capacitance and characteristic impedance are presented for the cases of symmetrically located, vertically offset, horizontally offset and arbitrarily offset inner conductors. The numerical results on normalized field distribution are presented for symmetric and vertically offset inner conductors.

The exact equations for the equipotential and flux line distributions in the cross section of a symmetric rectangular coaxial line are obtained using the conformal transformation technique. The complex potential function in the transformed parallel plate configuration is obtained in terms of incomplete and complete elliptic integrals of first kind. The flux and equipotential lines can directly be obtainable in the transformed parallel plate configuration by separating the

incomplete elliptic integral of first kind with complex argument into real and imaginary parts. To determine the corresponding contours in the original structure, a set of simultaneous non-linear equations are solved using the algorithm based on Fletcher-Powell unconstrained minimization technique. Numerical results on flux and equipotential lines are presented for one quadrant of the symmetric structure.

The closed form expressions for the line capacitance, characteristic impedance and normalized field distribution are obtained for the case of a rectangular coaxial line in which the bottom wall is removed. The expressions are derived for the general case of an arbitrarily located inner conductor using the Green's function formulation. The feasibility of using such a structure for probing the current induced on the wall of an enclosure is investigated by calculating the amplitudes of the signals coupled into the line due to an external surface current distribution exciting the line through the opening . Numerical results on line capacitance, characteristic impedance and the magnitude of the scattering coefficients are presented.

The normalized field distribution obtained in the cross-section is utilized to investigate the impedance properties of a thin, narrow slot cut in one of the ground planes of a symmetric rectangular coaxial line. The numerical results on normalized resistance and reactance of the slot are obtained for the cases of a) centered transverse slot,

(b) displaced transverse slot and (c) centered inclined slot. The variation of the amplitude of the scattering coefficient with frequency is also determined for the case of a centered transverse slot.

The characteristic impedance of a symmetric rectangular coaxial line in which the inner conductor is supported on a dielectric slab of equal width is determined using the conformal transformation technique. The contours of the transformed air-dielectric boundaries in the parallel plate configuration are determined with the objective of finding the capacitance of the dielectric filled half. The results on the characteristic impedance are presented for two values of the dielectric constant.

The field distribution for the symmetric structure mentioned above is determined using the method of finite-differences and the successive over relaxation scheme. The structure is divided into a large grid of rectangular meshes and the solution is found iteratively. The relaxation factor is chosen for which the iteration converges fastly. Results on equipotential and field distribution are presented.

A generalized analysis based on the conformal transformation and the Green's function formulation is presented for the determination of the capacitance per unit

length of a structure consisting of a semi infinite horizontal conducting plane separated from another finite-sized vertical conductor, by a gap. The results of the analysis are useful for the evaluation of the gap capacitance of a rectangular coaxial line terminated in a short-circuiting plane at one end. Numerical data on the gap capacitance are presented.