

# CALCULATION OF MICROSTRIP FIELDS USING ELECTROMAGNETIC SCALAR POTENTIALS

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Propagation constants and electric and magnetic fields of the propagation modes of open microstrip are computed using a hybrid method of computation. Analytical expressions for the propagation modes of a dielectric covered ground plane describe fields far from the microstrip, and numerical computations enforcing boundary conditions for a conducting surface on the conducting strip are used to find fields close to it. The analytical expressions are assumed to describe the fields on a boundary between the two regions, and fields inside this boundary are computed numerically by using the values computed from the analytical expressions as boundary values. Separate computations are carried out for each mode of a dielectric covered ground plane. Linear combinations of these modes are sought for which the derivatives of the fields are continuous at the boundary. The continuity conditions of the derivatives of the fields along the boundary are taken as a measure of the accuracy of the hybrid procedure.

Propagation modes of a dielectric covered ground plane have been classified as proper modes, whose amplitude decreases in the direction normal to the dielectric interface, and improper modes, whose amplitude increases in this direction. Microstrip fields are shown to have the same properties because they are constructed from the modes of a dielectric covered ground plane.

Calculations are carried out in terms of electromagnetic scalar potentials. Pairs of scalar functions are defined such that all components of the electric and magnetic fields can be derived from them. It is shown that scalar potentials can describe the fields when the components of their gradients in each of two orthogonal directions obey the wave equation, and that the coordinate system of the microstrip can be defined so that this is the case. The use of scalar potentials simplifies the calculations greatly, while retaining the accuracy of full vector calculations. Computation of the electric and magnetic fields from these potentials is demonstrated.

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