Abstracts

Wave Propagation in Microstrip Transmission Lines

G.I. Zysman and D. Varon. "Wave Propagation in Microstrip Transmission Lines." 1969 G-MTT International Microwave Symposium Digest of Technical Papers 69.1 (1969 [MWSYM]): 3-9.

With the growing popularity of integrated circuits the microstrip transmission line has received wide attention from the microwave community. A common feature that most known analytic solutions share is an assumption that the fundamental mode of propagation resembles a TEM wave closely enough to permit various electrostatic approximations such as conformal mapping, relaxation method, and variational principle. Such solutions although quite useful at low frequencies neglect the fact that the actual propagating modes cannot be TEM. The dispersion of non-TEM waves causes, at microwave frequencies, considerable deviations in effective dielectric constant and velocity of propagation from those values obtained by the electrostatic approximation. In this paper it is shown that the modes that exist on a microstrip transmission line must be hybrid in order that all boundary and continuity conditions be satisfied. In this rigorous analysis the hybrid modes are decomposed into sums of TE and TM (or LSE and LSM) space harmonics, each satisfying the wave equation and the external boundary conditions and their total satisfying the continuity conditions and boundary conditions on the strip. The final outcome of the analysis is a pair of coupled integral equations that are solved numerically. The results indicate that the fundamental hybrid mode is propagating at all frequencies and approaches the known static solutions at low frequencies. However, the correct solution deviates from the static approximation at microwave frequencies. Of particular interest is the fact that as the dielectric constant of the substrate increases the frequency range at which the TEM approximation is valid decreases. The results obtained show close agreement with available experimental data.

❑ Return to main document.