Abstracts

Optimization of Waveguide Tapers Capable of Multimode Propagation

C.C.H. Tang. "Optimization of Waveguide Tapers Capable of Multimode Propagation." 1961 Transactions on Microwave Theory and Techniques 9.5 (Sep. 1961 [T-MTT]): 442-452.

By converting Maxwell's equations, the general case of mode conversion in tapered waveguides is treated by matrix formulation in terms of an infinite set of coupled differential equations with nonuniform coupling coefficients and varying phase constants. An "orthogonalization" or "diagonalization" process is introduced through a nonlinear matrix transformation which is a function of taper length. The general matrix solution of the problem is obtained through a perturbation method in the form of an integral equation of the Volterra type, and the integral equation is solved by an iteration method. In view of the difficulties in finding eigenvalues, the problem is then reduced to the two-mode case, and the mode conversion is obtained in an explicit form revealing certain information which characterizes the choice of "mode-conversion distribution function." Optimization is first obtained through proper choice of the mode-converison distribution function. In an attempt to approximate a Tchebycheff mode-conversion response, further optimization is realized by creating "new zeros" and thereby changing the density of the distribution of zeros in the vicinity of the origin of the mode-conversion curve and the nature of the optimization procedure essentially becomes that of synthesis. Through using the optimized distribution function, a total reduction of about 50 per cent in taper length is realized (when compared with the cosine-squared distribution) for the case of 50-db prescribed-mode discrimination in a taper connecting a 7/8-in ID waveguide to a 2-in ID waveguide operating in the circular electric mode up to 75 kmc.

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