Abstracts

Coupling Between Dissimilar Waveguides

E.H. Kopp and R.S. Elliott. "Coupling Between Dissimilar Waveguides." 1968 Transactions on Microwave Theory and Techniques 16.1 (Jan. 1968 [T-MTT]): 6-11.

Investigators have used coupled-mode theory to analyze the coupling between identical waveguides; in such cases the coupling coefficients are found to be identical. If the waveguides differ, the coupling coefficients are asymmetrical and difficult to evaluate by strictly theoretical methods. An alternate approach to this case is considered in the present work. A pair of coupled-mode equations is first developed from a consideration of the permissible fields within the device. This clarifies the relationship between the coupled-mode theory and the more general classical electromagnetic theory by giving a careful definition of the coupled and the normal modes of a coupled structure. It is shown that the coupled-mode equations are an exact representation of the waveguide fields, although for engineering purposes it is often convenient to use approximate values of the coefficients of these equations. The mutual coupling coefficients are obtained from a two transmission-line model of the structure, with the actual coupling mechanism represented by a mutual impedance common to the two lines. For dissimilar lines, the ratio of the coupling coefficients is found to be equat to the ratio of the characteristic impedances. For the cases considered, this is the same as the ratio of the propagation constants of the uncoupled lines, which permits the coupling coefficients to be determined from relatively simple measurements. The adequacy of the theory has been confirmed by a series of experiments.

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