Abstracts

Quasi-TEM Analysis of Microwave Transmission Lines by the Finite-Element Method

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This paper describes a finite-element approach to the quasi-TEM analysis of several different types of isolated and coupled microwave transmission lines. Both the first- and higher order ordinary elements, as well as singular and infinite elements, are used to solve for the potential and field distributions in the cross section of the line. Next, the cross-sectional field distribution is inserted in a variational expression to compute the capacitance per unit length of the line, and the effective permittivity and characteristic impedance of the line are obtained from the capacitance value. A perturbational approach is developed for estimating the losses due to conductor and dielectric dissipation and computing the attenuation constant. Both the upper and lower bounds for the capacitance and the characteristic impedance are found by solving the original and the corresponding dual problem. Lines treatable by this method may contain an arbitrary number of arbitrarily shaped conductors, including a system of conductors placed either above a single ground plane or between two parallel ground planes, and inhomogeneous dielectric regions that can be approximated locally by a number of homogeneous subregions. The results obtained using the finite-element procedure have been compared for various types of microwave transmission lines and have been found to agree well with available theoretical and measured data.

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