Abstracts

Characteristic Impedances of Multiconductor Strip Transmission Lines

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The design of certain log-periodic microwave circuit elements requires a knowledge of the characteristic impedances of a system of four-coupled strip transmission lines. The system of four strip conductors between parallel ground planes is capable of supporting four different TEM modes which have different characteristic impedances. In this paper, the characteristic impedances of the four modes are determined by a variational method. The variational solution is an upper bound to the exact characteristic impedance of the line. In general, the coplanar strip conductors are located at an arbitrary (but identical) displacement from the parallel ground planes. When the separation between the broadside-coupled strips is precisely one-half the spacing between the parallel ground planes, two of the mode impedances may be determined exactly by means of conformal mapping. The variational solutions are compared to the exact solutions for this special case. Because of the "cell image" principle which holds for the problem, the mode solutions presented here also apply to various single- and two-conductor strip transmission lines with arbitrary displacements. As a result, solutions for the following strip line configurations are available from the analysis: a single strip conductor in a trough, or between parallel ground planes; two coplanar strips between ground planes; two broadside-coupled strips in a trough, or between parallel ground planes. An extensive set of curves are presented which show the characteristic impedances of the four modes as a function of the relative dimensions of the strip transmission line.

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