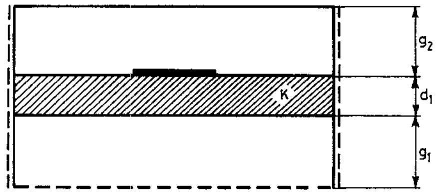

Fig. 1. Cross section of strip transmission line with magnetic wall at the bottom side.

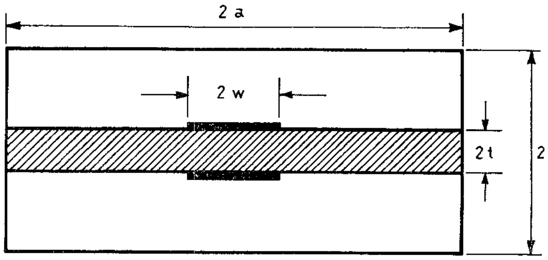

Fig. 2. Dielectric-supported air-strip transmission line.

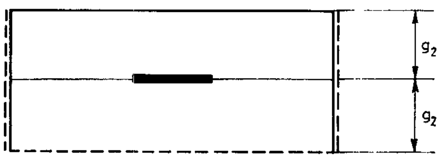

Fig. 3. Geometry for the homogeneous problem.

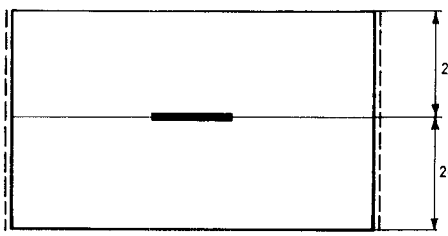

Fig. 4. Modified geometry for the homogeneous problem.

TABLE I

NUMERICAL RESULTS

2a	2b	2w	2t	THIS METHOD		GISH AND GRAHAM'S METHOD	
				Zo	vr	Zo	vr
2	2	1.6	1	22.64	.2481	22.71	.2475
2	2	.4	1	58.94	.2475	59.02	.2475
2	2	.4	.2	103 0	.2717	102.8	.2713
.9	6	.15	.2	72 60	.2607	72 68	.2606

calculation will give the same results for the two geometries. Hence the capacitance and the charge distribution in Fig. 3 can be easily obtained operating with Smith's conformal mapping process on the new dimensions in Fig. 4.

Finally, the published Fortran program [1] can be applied to the new structures simply by introduction of a suitable Green's function in the series expression. For example, in the case of electric side walls, Smith's ψ_m in [1, eq. (12)] should be written:

$$\psi_m = \frac{(1 + K \coth mg_1 \coth md_1)\rho_m}{m\{\coth mg_2(1+K \coth mg_1 \coth md_1)+K(K \coth mg_1+\coth md_1)\}}.$$

There is good agreement between the numerical results obtained with this method and the diagrams shown in [2]. This is exemplified by Table I where the values of the characteristic impedance Z_0, and the relative phase velocity v_r, for some geometrical configurations considered in [2, figs. 7, 8, 12, 13] and with the same relative dielectric constant of the substrate, are shown together with the values obtained with the present method. For the sake of greater precision the former values have been obtained by means of a computer program, according to [2], rather than by reading the diagrams. The geometrical dimensions are reported in Fig. 2, using the same notation as in [2].

In conclusion, the present method gives accurate results and the process of optimization of the charge distribution is avoided as in [1].

The saving in computer time obtained is of the order of 80 to 90 percent, which is very important in the analysis and optimization processes of complex geometrical structures.

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Conditions for Approximating the Limit-TEM Mode by a Quasi-TEM Mode in a Ferrite-Filled Coaxial Line

MELVIN M. WEINER

***Abstract*—Sufficient conditions for the quasi-TEM mode in a ferrite-filled coaxial line are reviewed.**

Using a Taylor series expansion of the Bessel functions in the determinantal equation for the limit-TEM mode in a ferrite-filled coaxial line, Wolff [1] has shown that the conditions

$$|s_1|(r_a - r_i) \ll 1 \qquad |s_2|(r_a - r_i) \ll 1 \tag{1}$$

are more general sufficient conditions than the conditions

$$|s_1| r_a \ll 1 \qquad |s_2| r_a \ll 1 \qquad |s_1| \ll r_i \qquad |s_2| r_i \ll 1 \tag{2}$$

which were originally proposed by Weiner [2] for approximating the limit-TEM mode by a quasi-TEM mode. The propagation constant for the quasi-TEM mode in coaxial geometry was shown by Teragawa *et al.* [2, ref. [2]–[5]] to be identical to the Suhl and Walker equation in parallel-plane geometry.

Unfortunately, Wolff attributes conditions (1) to Brodwin and Miller [3]. However, Brodwin and Miller [3] do not state conditions (1), but instead state on page 497: "The results of the numerical analysis show that the Suhl and Walker equation is a close approximation to the propagation constant [of the limit-TEM mode] for the lossless case. The approximation is especially valid for magnetic fields much larger than the resonant field, and for close spacing between inner and outer conductors."

The first sentence of their statement is generally not true and was the subject of correspondence by Weiner [2], [4] and Lewis [5].

As a test of the latter part of the second sentence, Weiner [2] explicitly proposed conditions (1) but rejected them as not being sufficient for reasons recently shown by Wolff [1] to be incorrect. Although Brodwin and Miller [2] believed that conditions (2) were not necessary, they neither proposed nor argued in support of conditions (1). Instead they argued that the Suhl and Walker equation was approximately valid even if conditions (1) were not satisfied [2, entries 1 and 3 in Table I].

In conclusion, conditions (1) should not be attributed to Brodwin and Miller. On the other hand, Wolff's validation of conditions (1), first mentioned by Weiner, is greatly appreciated.

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Two-Mode Waveguide for Equal Mode Velocities: Correction

N. G. ALEXOPOULOS AND M. E. ARMSTRONG

***Abstract*—The T-septum waveguide was analyzed by Elliott using the orthonormal block method. The numerical results did not compare favorably with experimental measurements and it was suggested that the disparity was related primarily to the assumption of zero-thickness membranes for the septum. Later, Silvester analyzed the T-septum waveguide using a finite-element method and found very good agreement with the measured points, yet the septum thickness was again assumed to be infinitesimal. This letter is being written to dispel the implication that the orthonormal block method of analysis of the T-septum waveguide suffers for lack of accuracy. The universal curves as shown by Elliott will be presented here in corrected form along with experimental results further corroborating both Elliott's and Silvester's work.**

Elliott's analysis [1] of the T-septum waveguide using the orthonormal block method has been corroborated by recent numerical calculations utilizing his theoretical formulation and by additional experimental measurements. It has been determined that errors existed in the original computer program used for the determination, numerically, of cutoff wavenumbers from the difference-mode Rayleigh–Ritz approximation.

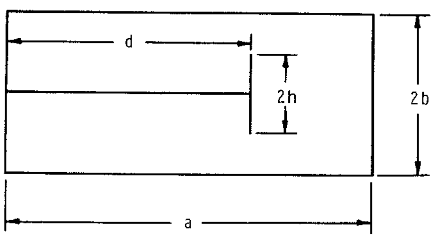

Fig. 1. T-septum waveguide geometry.

The T-septum waveguide geometry is indicated in Fig. 1, and the corrected cutoff wavenumbers for the sum and difference modes are shown in Fig. 2 for a range of septum dimensions. Fig. 3 shows the calculated guide wavelengths for the cases $h/b=0.3$, 0.5 and 0.8, along with experimentally determined guide wavelengths for these same T-septum aspect ratios. The heavy solid curves (theoretical) and the heavy dashed curve (experimental) in Figs. 2 and 3 give d as a function of h such that, over the frequency range for which these two modes propagate, their phase velocities will be equal. It is noted that there is satisfactory correspondence between experimental and theoretical characteristics for moderate septum insertion depths and that the results deviate markedly for large insertion depths, possibly because of the considerable difference between theoretical and experimental T-septum models. However, in the region of interest, namely for those values of insertion depth for which the phase velocities of the two modes are equal, there is excellent agreement, indicating, therefore, the validity of the theoretical model for predicting the physical model characteristics.

For purposes of comparison the current theoretical and experimental data are presented in Fig. 4 ($h/b=0.3$) along with the theoretical characteristics determined earlier by Silvester ($h/b=0.3$) [2]

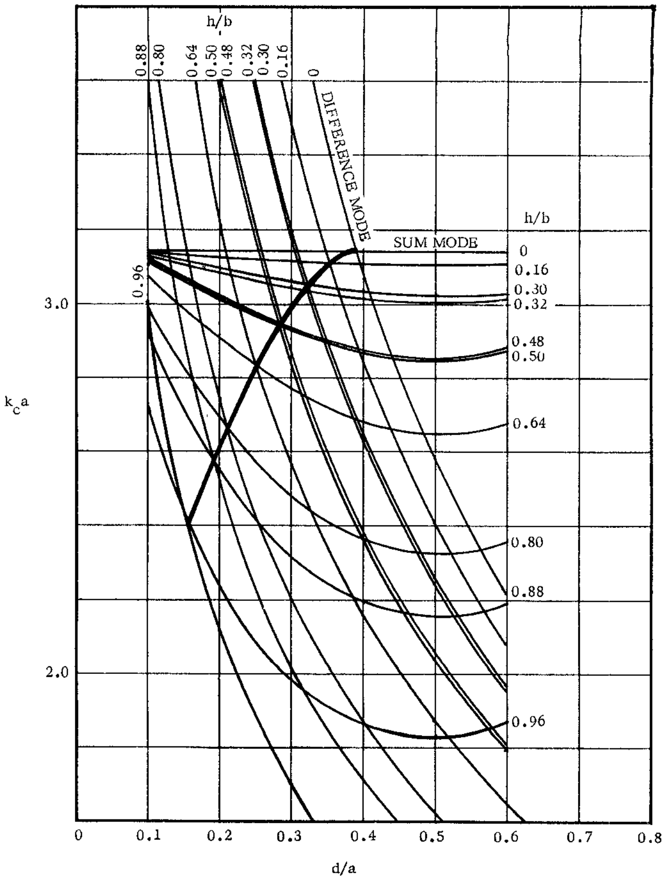

Fig. 2. Cutoff wavenumbers for sum and difference modes.

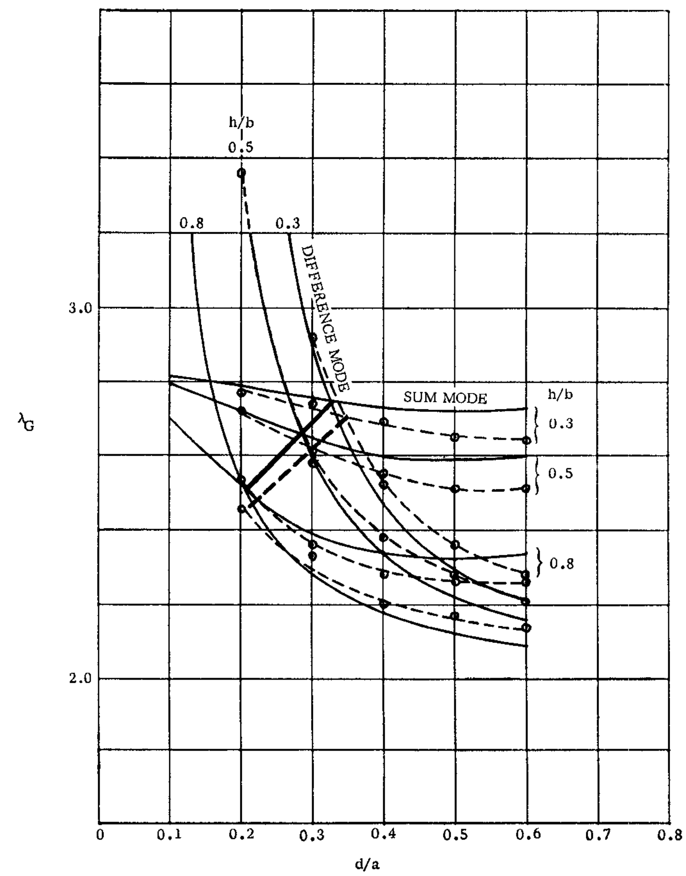

Fig. 3. Guide wavelengths of 6 GHz for sum and difference modes. (————) theoretical. (⊙------⊙) experimental

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