RADIATION FROM AN OPEN PARALLEL-PLATE WAVEGUIDE WITH A MATCHING ZONE

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Radiation from an open parallel-plate waveguide has been treated by many authors [1]-[5]. In this paper we add a matching zone to the parallel-plate waveguide (Fig. 1), and hope that this matching zone can reduce the reflection.

To deal with this new structure, we first apply the equivalence principle to divide the whole problem into three regions (Fig. 2): (I) a shorted parallel-plate waveguide excited by a TEM wave and an equivalent magnetic current M_i, (II) a half space with an equivalent magnetic current M_0 in an infinite ground plane, and (III) the matching zone excited by both $-M_i$ and $-M_0$. The magnetic current on the inlet

$$\overline{M}_i = \overline{E} \times (-\hat{\xi}) = M_i \hat{y} \tag{1}$$

with E the electric field on the aperture A_i and ξ the direction of the parallel-plate waveguide. The other magnetic current

$$\overline{M}_o = \overline{E} \times \hat{z} = M_o \hat{y} \tag{2}$$

is on the outlet, and E is the electric field on the aperture A_0.

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Next, we use two set of pulse basis functions to expand M_i and M_O, respectively, and apply the continuity of the magnetic field across the apertures A_i and A_O to achieve a matrix equation

$$([Y^R] + [Y^C]) [V] = [I] \tag{3}$$

It is derived in a manner similar to the generalized network formulation [6]. In deriving (3), point matching has been utilized. Column vector [V] consists the coefficients of expansion for the equivalent magnetic current M_i and M_O, and is to be solved. The right-hand-side term [I] is related to the reflection of the incident TEM wave at the shorted end, and thus can be determined easily. The admittance matrix [Y^R] can be divided into two parts: One part is obtained from the image principle as in [7], and the other part is computed by the modal expansion method. Finally, the cavity admittance matrix [Y^C] is evaluated by the finite element technique described in [7].

From (3) we may get the equivalent magnetic currents on A_i and A_O. From M_i we may get the reflection coefficient. Fig. 3 presents the reflection coefficient for the case without the matching zone. This result agrees very well with the one given in [3]. In Fig. 4, we consider an open parallel-plate waveguide with a trapezoid matching zone. It is found that a suitable matching zone can significantly reduce the reflection.

ACKNOWLEDGEMENT

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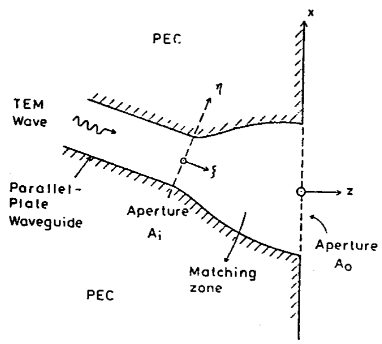


Fig .1

Open parallel-plate waveguide with a matching zone

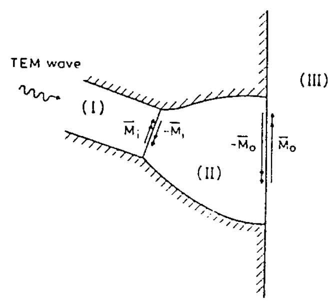
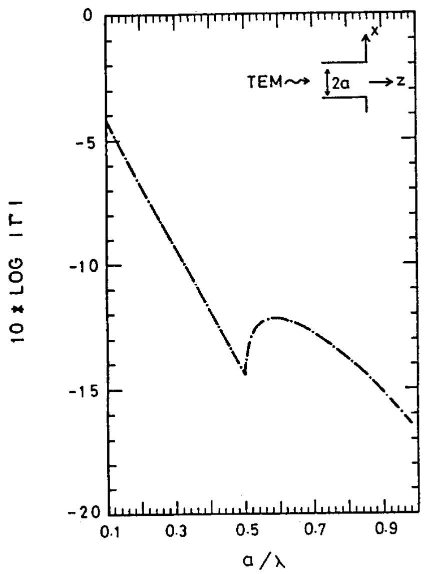


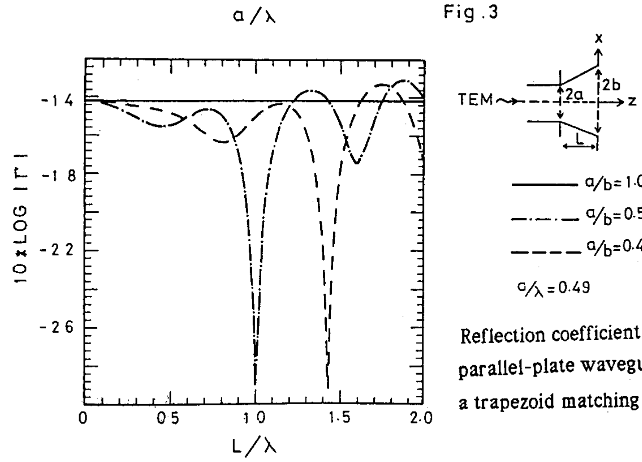
Fig . 2

Subproblems



Reflection coefficient of an open parallel-plate waveguide

Fig .3



Reflection coefficient of an open parallel-plate waveguide with a trapezoid matching zone

Fig .4