where γ_n^2 are the squared wavenumbers of the background waveguide modes (for lossless waveguides, γ_n^2 are real quantities, positive or negative). Similar to nonuniform free space waves, nonuniform waveguide modes propagate along a given direction and attenuate/grow along the orthogonal one. The complex wavevector $\boldsymbol{k_n}$ can be written as the sum of a real part and an imaginary part

$$\boldsymbol{k}_n = \beta_n \hat{\boldsymbol{u}}_n - j\alpha_n \hat{\boldsymbol{v}}_n, \tag{3}$$

where β_n is the phase constant of the nonuniform waveguide mode, and α_n is its attenuation constant (β_n and α_n are real numbers). From (2) and (3), we find that

$$\beta_n^2 - \alpha_n^2 = \gamma_n^2 \tag{4}$$

and

$$\hat{\boldsymbol{u}}_n \cdot \hat{\boldsymbol{v}}_n = 0. \tag{5}$$

The leaky wave in the line will excite nonuniform waveguide modes contributing to the far radiation field. The *phase* as well as *attenuation match conditions* must be satisfied by all the nonuniform modes

$$\mathrm{Re}\,(k_l) = \beta_n \cos\theta_n, \tag{6}$$

$$\mathrm{Im}\,(k_l) = -\alpha_n \sin\theta_n, \tag{7}$$

where θ_n is the angle between the direction of propagation of the transmission line and the leakage direction, $\hat{\boldsymbol{u}}_n$. For *physical* waves, θ_n must be a real number and the basic *phase match constraint* can be written as

$$\mathrm{Re}\,(k_l) < \beta_n. \tag{8}$$

When $\beta_n \simeq \gamma_n$ (i.e. when the n-th waveguide mode is almost uniform), which implies (from (4) and (6)) $\alpha_n \simeq 0$ and $\mathrm{Im}\,(k_l) \simeq 0$, (6) can be approximated as:

$$\mathrm{Re}\,(k_l) \simeq \gamma_n \cos\theta_n, \tag{9}$$

or

$$\mathrm{Re}\,(k_l) < \gamma_n, \tag{10}$$

which is the approximate phase-match condition as given by (42) of [1]. When β_n is different from γ_n (or, when the excited background wave is nonuniform), though in many reported cases the condition (10) is known to apply, it does not *necessarily* follow from (8). The leaky waves with the phase constant, $\mathrm{Re}\,(k_l)$, greater than the wavenumber, γ_n, recently reported in [4] and elsewhere as nonconventional leakage, are such situations.

If the condition (10) does not apply for general cases, another rigorous criterion of excitation of leakage must be searched for. It may be noted that the basic condition (8) is not useful, because unlike the wavenumber, γ_n, the phase constant, β_n, is not an independent physical parameter and is a function of both γ_n and k_l. In fact, as it can be shown, for a given complex propagation constant, k_l, and wavenumber, γ_n, there are always two sets of solutions for β_n, α_n and θ_n satisfying (4), (6), and (7), one of which always satisfies the condition (8), making the criterion (8) indeterministic. Further investigation for a proper criterion of leakage valid in general situations is warranted.

References

[1] D. Phatak, N. K. Das and A. P. Defonzo, "Dispersion characteristics of optically excited coplanar striplines—Comprehensive full-wave analysis," *IEEE Trans. Microwave Theory Tech.*, vol. MTT-38, pp. 1719–1730, Nov. 1990.

[2] N. K. Pozar and D. M. Pozar, "Full-wave spectral-domain computation of material, radiation and guided-waves losses in infinite multilayered printed transmission lines," *IEEE Trans. Microwave Theory Tech.*, MTT-39, pp. 54–63, Jan. 1991.

[3] R. B. Adler, L. J. Chu, and R. M. Fano. *Electromagnetic Energy Transmission and Radiation.* Cambridge: The M.I.T. Press, 1969.

[4] D. Nghiem, J. T. Williams, D. R. Jackson, and A. A. Oliner, "Leakage of the stripline dominant mode produced by a small air gap," *1992 IEEE-MTT Symp. Dig.*, pp. 491–494.

Corrections to "TE-Mode Scattering from Two Junctions in H-Plane Waveguide"

Hyo Joon Eom

In the above paper,[1] there are serious printing errors that need to be corrected. The corrections are as follows: In (9) and (14), *j* should be replaced by *i*. In (35), 'when $d = a$ and α 0' should be replaced by 'when $b_m = a_n$ and $\alpha = 0$'.

In (31), (32), (44), and (45), ds should be replaced by $d\zeta$. In (40) and (49) $|s = \sqrt{ki^2 - (e\pi/b)^2}$ should be replaced by $|_{\zeta=\sqrt{k_1^2-(l\pi/b)^2}}$. Equation (36) should read

$$B_m = -\pi[|d-a|e^{\imath\zeta|d-a|} - (-1)^m|d+a|e^{\imath\zeta|d+a|}]$$

. Equation (39) should read

$$r_{nm} = \sum_{l=1}^{\infty} 2\cos(l\pi)T_{\xi\xi}[1-(-1)^m e^{\imath 2\sqrt{k_1^2-(l\pi/b)^2}a}]$$

. Equation (48) should read

$$z_{nm} = \sum_{l=1}^{\infty} 2\cos(l\pi)T_{\eta\eta}[1-(-1)^m e^{\imath 2\sqrt{k_1^2-(l\pi/b)^2}d}]$$

In (56), $e^{-\imath k_{xs}d}$ should be replaced by $e^{-\imath k_{xs}d}$].

Manuscript received August 26, 1994.

The author is with the Department of Electrical Engineering, Korea Advanced Institute of Science and Technology, Taejon 305-701 Korea.

IEEE Log Number 9406803.

[1] J. W. Lee and H. J. Eom, "TE-mode scattering from two junctions in H-plane waveguide," *IEEE Trans. Microwave Theory Tech.*, vol. 42, no. 4, pp. 601–606, Apr. 1994.

0018-9480/95$04.00 © 1995 IEEE