Letters

Comments on "Analysis of an End Launcher for a Circular Cylindrical Waveguide"

PROBIR K. BONDYOPADHYAY

I have read with interest the above paper[1], the contents of which are erroneous and misleading.

In the paper, following equation (6) on page 673, the authors state: "The circular waveguide supports only dominant ($i=0$) TE_{11} mode. The current $\vec{J}_{AB}$ excites only TM modes (TM_{op} for $D=0$ and TM_{np} for $D\neq 0$) which are higher order modes in the waveguide." This is not true. The authors are in violation of Maxwell's fifth equation (continuity of current), and are not considering the effect of the full current loop inside the circular waveguide, especially the effect of the "return" current through the lower inner wall of the waveguide. As a result, they are missing the presence of the TEM mode in the circular waveguide in the transition region $0\leqslant z\leqslant L_1$. The circular waveguide in Fig. 1 is a two conductor transmission line in the region $0\leqslant z\leqslant L_1$ because of the presence of the inner conductor (section AB) and, therefore, supports the TEM mode in that portion. This TEM mode in the circular waveguide is excited by the TEM mode carrying coaxial line feeding the waveguide and its presence cannot be neglected because the length L_1 is comparable to the operating wavelength. The TEM mode excited by the current $\vec{J}_{AB}$ in (8) together with the "return" current $\vec{J}_{CA}$ through the inner lower wall of the circular waveguide after reflection at $z=L_1$, and traveling in the $-z$ direction contribute to the input impedance in (7). In network terminology, this means the end launcher is not only an impedance transformer but also a balun. The authors did not mention this contribution.

It has already been pointed out [1] that the expression for X_1 in (13) in the above paper, is incomplete and erroneous, because the authors did not consider the contribution of the higher order TE modes with cos $n\varphi$ variations in the radial component of the electric field excited by the assumed current distribution in (9). Further, the partial expression for X_1 in (13) is also absolutely divergent. This can be easily verified if the series summation is attempted with respect to index 'p' for a fixed 'n'. The authors, therefore, have no basis to conclude: "It is found that the terms $p=1$, $n=0,1,\cdots,12$ have significant contribution to X_1 and contribution of other terms is negligibly small."

At this point one wonders how the authors using an erroneous and divergent expression for the input impedance to calculate the input VSWR could arrive at the conclusion: "There is a good agreement between theoretical and experimental results on input VSWR...."

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[1]M. D. Deshpande and B. N. Das, *IEEE Trans. Microwave Theory Tech.*, vol. MTT-26, pp. 672–675, Sept. 1978.

Reply[2] by B. N. Das and M. D. Deshpande[3]

The authors thank P. K. Bondyopadhyay for reading their paper[1] with interest.

Regarding the first paragraph of the comments, the authors would like to point out that the doubts raised by Mr. Bondyopadhyay regarding the presence of TEM modes, were included already in his comments on an earlier paper by Das and Sanyal [2]. The corresponding explanation is included in the reply to the comments, which is under publication in *Proceedings of the Institution of Electrical Engineers* (London).

As far as the remaining part of the comments is concerned, it may be pointed out that these aspects are also included in the comments of Mr. Bondyopadhyay on an earlier paper by the authors [3]. The reply to these comments is scheduled for publication in IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES, vol. MTT-27, March 1979.

The authors do not consider it necessary to repeat the explanations.

REFERENCES

[1] P. K. Bondyopadhyay, Comments on "Input impedance of coaxial line to circular waveguide feed," to be published.

[2] B. N. Das and G. S. Sanyal, "Coaxial line to waveguide transition end launcher type," *Proc. I.E.E.*, vol. 123, no. 10, pp. 984–986, Oct. 1976.

[3] M. D. Deshpande and B. N. Das, "Input impedance of a coaxial line to circular waveguide feed," *IEEE Trans. Microwave Theory Tech.*, vol. MTT-25, pp. 954–957, Nov. 1977.

[2]Manuscript received January 15, 1979.

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Correction to "Comments on 'In Impedance of Coaxial Line to Circular Waveguide Feed'"

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In the above correspondence[1] the expression of the Hankel asymptotic approximation for Bessel functions on page 284, should read *without the subscripts "np" in the argument x* of the Bessel functions as

$$J_n(x) \underset{\substack{x\to\infty \\ n,\ \text{fixed}}}{\sim} \sqrt{\frac{2}{\pi x}}\ \cos\left(x-\frac{\pi}{4}-\frac{n\pi}{2}\right).$$

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[1]P. K. Bondyopadhyay, *IEEE Trans. Microwave Theory. Tech.*, vol. MTT-27, p. 284, Mar. 1979.

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