Comments on "Branch-Line Couplers Using Unequal Line Lengths"

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In the above paper,[1] Toker *et al.* maintain that the general solution of branch-line couplers is provided. In fact, the more general coupler was published in 1992 [1]. Simplifying the general structure [1] by removing the lumped elements, one can get the branch-line coupler shown in Fig. 1.

The relationships given in [1] allow to derive the following set of equations:

$$nz_1 \sin\theta_{1c} = z_3 \sin\theta_{3c} \tag{1}$$

$$n \cos\theta_{1c} = \cos\theta_{3c} \tag{2}$$

$$z_2 = \frac{\sqrt{n} z_1 \sin\theta_{1c}}{\sqrt{(1-n) + n(1+z_1^2)\sin^2\theta_{1c}}} \tag{3}$$

$$z_1 \tan\theta_{1c} = -z_2 \tan\theta_{2c} \tag{4}$$

$$|S_{31}| = \frac{1}{\sqrt{1 + nz_1^2 \sin^2\theta_{1c}}} \tag{5}$$

$$|S_{21}| = |S_{31}| \sqrt{n} z_1 \sin\theta_{1c} \tag{6}$$

where $n = Z_{02}/Z_{01}$ $z_i = Z_i/(Z_{01}Z_{02})^{1/2}$ $(i = 1, 2)$ and index c corresponds to the center frequency at which (1)–(6) are fulfilled.

Equations (1)–(6) were first published in 1977 [2].

As one can see, the coupler considered in the above paper is obviously a particular case of the generalized branch-line coupler.

The same coupler as the one presented in the above paper was also published in 1988 [3].

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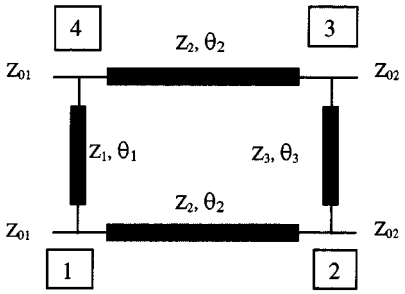

Fig. 1. Schematic view of the branch-line coupler-transformer.

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Authors' Reply

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In the comments on the above paper,[1] as the name implies, the main emphasis in [1] of these comments is given to the lumped-element and transmission-line combinations in a branch-line coupler. However, nowhere in [1] is the structure of a branch-line coupler containing only unequal length transmission lines mentioned, nor the design equations written. Therefore, our results are included there implicitly.

We thank R. W. Vogel for bringing [3] to our attention in his comments. The work presented in [3] is quite similar to ours; however, the title does not specifically imply unequal line lengths, which caused the unavoidable skip during the literature search.

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