Letters

Comments on "Phase Shifts in Single- and Dual-Gate GaAs MESFET's for 2–4-GHz Quadrature Phase Shifters"

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In the above paper,[1] the authors have discussed the variation of transmission phase for single- and dual-gate GaAs MESFET's when the bias is changed.

In Section II of their paper, the authors have a discussion on bias-voltage variation that affects only the intrinsic elements of the equivalent circuit. Parasitics are therefore removed from the model and the authors end up with a resulting circuit (see Fig. 1 here). In using the circuit in Fig. 1, the authors present a transmission phase equation (eq. (1)) which is incorrect. The correct transmission phase is given by

$$\angle S_{21} = \pi - \tan^{-1}(A) - \tan^{-1}\left(\frac{x}{y}\right) \tag{1a}$$

where

$$A = \frac{\omega\tau_2 + \sin\omega\tau}{\cos\omega\tau + \omega^2\tau_1\tau_2}$$

$$x = \omega\left(\tau_3\frac{G_{ds}+G_L}{g_{mo}}\cdot\frac{G_{ds}}{G_s} + \tau_1\cdot\frac{G_{ds}+G_L}{g_{mo}} + \frac{C_{dg}+C_{ds}}{g_{mo}} + \frac{C_{dg}}{G_s}\cos\omega\tau\right) - \omega^3\tau_1\tau_2\frac{C_{ds}}{G_s}$$

$$y = \frac{G_{ds}+G_L}{g_{mo}} + \omega\frac{C_{dg}}{G_s}\sin\omega\tau - \omega^2\left(\tau_1\tau_2\cdot\frac{G_{ds}+G_L}{G_s} + \tau_1\cdot\frac{C_{ds}+C_{dg}}{g_{mo}} + \tau_3\cdot\frac{C_{ds}+C_{dg}}{g_{mo}}\cdot\frac{G_{ds}}{G_s} - \tau_2\frac{C_{dg}}{G_s}\right)$$

τ = transit time in gate region

$\tau_1 = R_i \cdot C_{gs}$

$\tau_2 = C_{dg}/g_{mo}$

$\tau_3 = (C_{gs} + C_{dg})/G_{ds}$

$G_S = 1/R_S$

$G_L = 1/R_L$.

There seems to be a typographical error in the x function of the above paper. In the first parenthesis, the last plus sign should be a multiplication sign.

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[1] J. P. Mondal, A. G. Milnes, J. G. Oakes, and S.-K. Wang, *IEEE Trans. Microwave Theory Tech.*, vol. MTT-32, pp. 1280–1288, Oct. 1984.

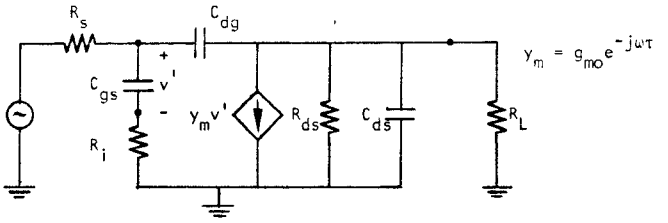

Fig. 1. Equivalent circuit.

TABLE I
COMPUTER RESULTS FOR TRANSMISSION PHASE

Frequency in GHz	Referenced paper[1] $\angle S_{21}$ (degrees)	Correct formula $\angle S_{21}$ (degrees)
2.0	- 10.9735°	146.7010°
3.0	- 15.6446°	131.2912°
4.0	- 19.5384°	117 0236°
10.0	- 28.7725°	51.6532°
15.0	- 26.7011°	12.7215°
20.0	- 21.4983°	- 19.1093°

In Table I, computer results for the transmission phase are shown using element values in Fig. 2 of the paper in question with parasitics removed. Table I

Reply[2] by J. P. Mondal, A. G. Milnes,[3] J. G. Oakes,[4] and S.-K. Wang[5]

We thank Mr. Vickes for pointing out the mistake in the expression reported in our paper and for supplying the correct expression. In our actual calculations, the original Y-matrix elements were used in matrix form; therefore, the curves and the conclusions reported in the paper remain unaffected.

[2] Manuscript received September 27, 1986.

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