Letters

Comments on "Sensitivity Analysis of Lossy Coupled Transmission Lines"

Iwata Sakagami

In Fig. 5 of the above paper,[1] a good agreement between the numerical inversion of Laplace transform (NILT) and HSPICE is presented on the transient response of transmission line system with lumped terminal and interconnecting networks. However, I would like to mention some comments in the following.

It can be said that the waveform shown in Fig. 5 of the above paper reaches the stationary state in the almost flat region of 10–14 nsec. My opinion is that the stationary value must equal to the output value of a resistive network, Fig. 1, which is derived from Fig. 2 of the above paper by having the capacitors open and the inductors short. The Vout1 and Vout2 in Fig. 1 correspond to the output voltages across the 1-pF capacitor and the 30-Ω resistor located at the right edge of Fig. 2 of the above paper, respectively. Under the 5-V dc source, we have $\mathrm{Vout1} = 0.0049474$ and $\mathrm{Vout2} = 0.0026986$. Therefore, the transient response shown in Fig. 5 must approach these values gradually in the flat region. However, the result shown in Fig. 5 is completely different from these values.

Fig. 2(a) shows the calculated transient responses, Vou1 and Vou2, which correspond to the above-mentioned Vout1 and Vout2. The input voltage waveform is shown in Fig. 2(b), where the case of $t_1 = 1$ and $t_2 = 11$ nsec represents the input waveform shown in Fig. 4 of the above paper. The case of $t_1 = 1$ and $t_2 = 60$ nsec was newly calculated in order to confirm the response at the stationary state. The calculation was done by using the fast Laplace transform [1] and the equation of $\mathrm{Vout}(t) = L^{-1}[E(s)G(s)]$, where L^{-1} is the inverse Laplace transform, $E(s)$ the input function in s-domain and $G(s)$ the voltage transmission coefficient from input port to output port. Here, $G(s)$ can be obtained from Fig. 2 of the above paper directly. In making up Figs. 1 and 2(a), I understand that Fig. 2 of the above paper was obtained using the circuit block shown in Fig. 3 of the above paper as the first stage and cascading four circuits given by the source and a 75-Ω resistor connected to the source in Fig. 3 of the above paper being removed.

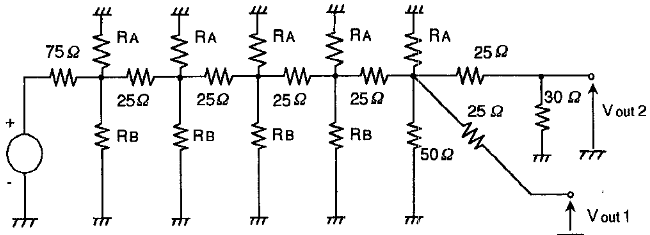
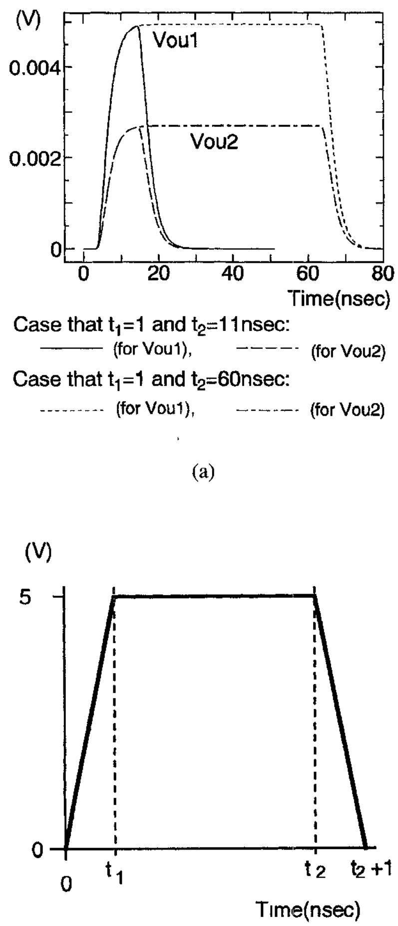


Fig. 1. Resistive network derived from Figs. 2 and 3 of the paper[1] by the dc analysis. $R_A = 475/16$, and $R_B = 550/21$.



(b)

Fig. 2. (a) Transient responses of the circuit in Fig. 2 of the above paper. Vou1 and Vou2 are voltages across the 1-pF capacitor and 30-Ω resistor at the right edge of Fig. 2. (b) Voltage waveform used as the source of the circuit in Fig. 2 of the above paper.

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[1] S. Lum, M. S. Nakhla, and Q. J. Zhang, *IEEE Trans. Microwave Theory Tech.*, vol. 39, no. 12, pp. 2089–2099, Dec. 1991.

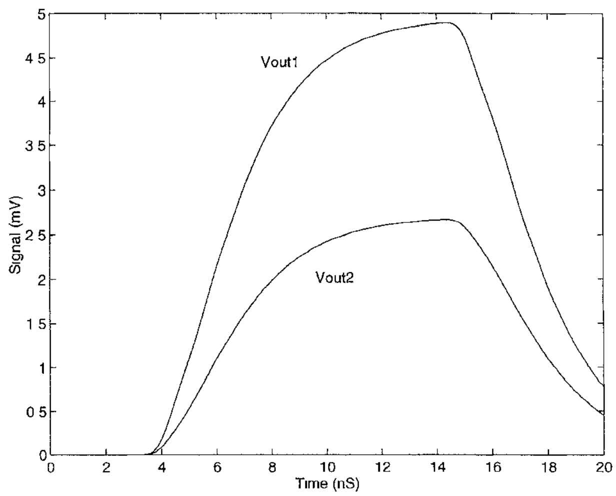

Fig. 3. Vout1 and Vout2 without the 75-Ω input resistors in the cascaded sections.

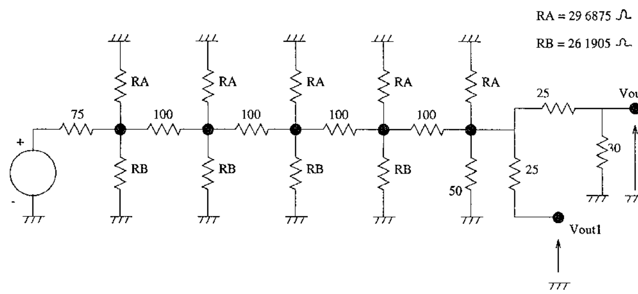

Fig. 4. The dc network including the 75-Ω input resistance

Authors' Reply by S. Lum, M. S. Nakhla, and Q. J. Zhang

Obviously, the steady-state response can be obtained by having all the capacitors open and all the inductors short. The reason that the author of the comment got a different answer from the one presented in our paper is that his calculation did not take into account the 75-Ω input resistance of the cascaded structure As mentioned in our paper, the circuit of Example 1 is obtained by cascading four sections to the circuit of Fig. 3 of our paper. Please note also that we used Fig. 2 to symbolically identify the connection points between the cascaded sections, the output ports, and some of the components which were used later in our paper in the sensitivity analysis comparison. Fig. 2 of our paper was not meant to be used to give the details of the individual cascaded sections. These details are given clearly in Fig. 3 of our paper.

For numerical verification, we repeated our analysis with and without the 75-Ω resistance in the cascaded sections. The following is a summary of the results:

- Fig. 3 (of this reply) shows the output waveforms obtained without the 75-Ω. The peak voltages for V_{out1} and V_{out2} match very well the dc calculations done in our paper.
- Fig. 4 (of this reply) shows the dc network including the 75 Ω. The output voltages calculated using the dc network are $V_{out1} = 0.1159$ mV and $V_{out2} = 0.0632$ mV, which match the peak values of the waveforms reported in our paper.

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Comments on "Measurement of the Microwave Conductivity of a Polymeric Material with Potential Applications in Absorbers and Shielding"

Wen-Pin Liao and Fu-Lai Chu

In Fig. 5, Fig. 7, and Fig. 8 of the above paper,[1] Naishadham and Kadaba have demonstrated the utilization of polyacetylene and PBT conductive polymers as single-layer, double-layer electric Salisbury screen and EMI shield. However, some inconsistencies were found between the calculated results and the assumptions stated in the paper.

As indicated in the paper[1], a comparison between the measured results of dc and microwave conductivities indicates that the microwave conductivity at room temperature is within a small percentage of the dc result and can be used for a wide frequency range. Therefore, the conductivity of the polymers given by $\sigma = 2\pi f_0 \epsilon_0 \epsilon''$ is assumed invariant for all frequencies. Based on this assumption, the shielding effectiveness as a function of frequency for 64-mil-thick free-standing films of polyacetylene and PBT is recalculated and is shown in Fig. 1. Apparent discrepancy is found by comparing it with Fig. 8 of the above paper[1]. It is interesting to find that the shielding effectiveness based on the invariability of ϵ'' for all frequencies determined from the measured results, $\epsilon^* = \epsilon' - j\epsilon'' = 5.1 - j607$ for polyacetylene at 8.895 GHz and $\epsilon^* = 3.0 - j838$ for PBT at 9.89 GHz, shown in Fig. 1, agrees completely with Fig. 8 of the above paper[1]. It is concluded that shielding effectiveness in Fig. 8 of the above paper[1] is under the assumption of frequency invariance of ϵ'' instead of σ.

On the other hand, for the return loss of a single-layer electric Salisbury screen comprising resistive sheets of polyacetylene or PBT, shown in Fig. 5 of the above paper[1], the calculation differences based on the invariability of σ and on the invariability of ϵ'' for all frequencies are insignificant.

For the return loss of a double-layer electric Salisbury screen shown in Fig. 7 of the above paper[1], the recalculation based on the invariability of σ for all frequencies is shown as trace (a) in Fig. 2, which agrees with the comment given by du Toit [1]. The return loss under the assumption of frequency invariant ϵ'' is shown

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[1] K. Naishadham and P. K. Kadaba, *IEEE Trans. Microwave Theory Tech.*, vol. 39, pp. 1158–1164, July 1991.