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SHORT COMMUNICATION
Useful Simple Equivalents of Uniformly Distributed R-C ($\overline{\text{URC}}$) Notch Filters

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Simple single π and T section equivalents of $\overline{\text{URC}}$ notch filters are presented which have been developed using the technique postulated in a previous paper.[1] The models are deemed to be of considerable use in practical design and analysis owing to their much improved simplicity.

Frequency selective characteristics can be obtained by the notch configuration without the use of a conventional inductor whose fabrication in semiconductor integrated circuit form poses considerable difficulty. The null characteristic is usually obtained by placing a resistor in series with the capacitive terminal of the $\overline{\text{RC}}$ structure, as proposed originally by Kaufman.[2] Two-port modelling of $\overline{\text{RC}}$ notch filters has received only little or scanty attention so far. Recently Kumar[1] has a developed a rational two-port model for $\overline{\text{URC}}$ notch filters including all possible parasitics, irrespective of their magnitude. This study was intended to be thorough, exhaustive and complete in determining the effect of parasitics on notch performance. The model thus got unnecessarily complicated in an attempt to be all inclusive. In the present communication a much more simplified version of the π section model along with a simple T section model is given.

Several authors have pointed out that the influence of dielectric leakage conductance on circuit operation can be ignored.[3–5] The dielectric leakage conductance parameter A is, in actual practice, negligibly small. Further the notch resistor is almost always lumped except for the very few cases when it is distributed in special configurations.[6,7] Also, in such configurations, it has been noted that the distributed capacitance associated with the notch resistor can be negligible. Thus the parameter, N, can also be ignored in actual practice. Introducing these two modifications, the model reduces to a very simple form (Figure 1).

It must be observed that the two shunt arms of the model contain identical elements in an identical topology.

Further, a T section model is more natural in its resemblance to the notch configuration. It has the additional advantages that the transfer function and the notch conditions can be easily derived and is perhaps better suited to the analysis and design purposes of $\overline{\text{URC}}$ notch filters. Employing the same continued fraction expansion with optimum truncation scheme as in the previous paper,[1] but now applying this to the open circuit impedance or z parameters of the $\overline{\text{URC}}$ line, the very simple single T section equivalent of Figure 2 results. This model is also reasonably accurate as demonstrated by its

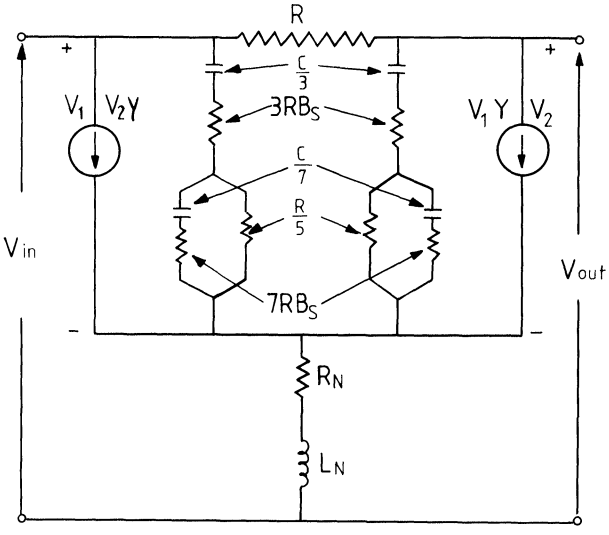

FIGURE 1 The proposed model for $\overline{\text{URC}}$ notch filters including parasitics. $Y = p[980(1 + pB_S) - 11p]/\{R(1 + pB_S)\text{-}[5880(1 + pB_S) + 620p]\}p = j\omega CR$.

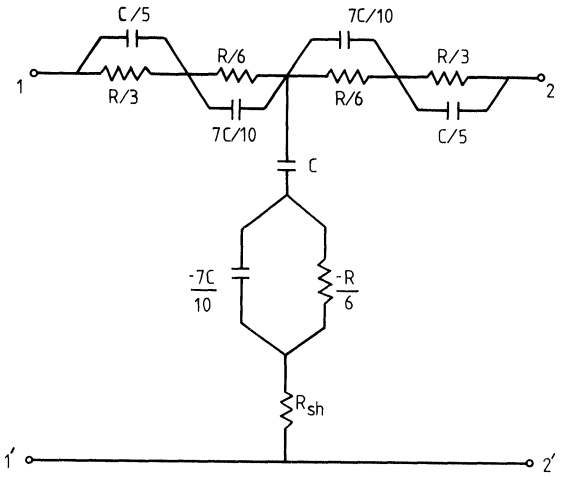

FIGURE 2 *T* Section model of $\overline{\text{URC}}$ notch filters.

prediction of the $\overline{\text{URC}}$ notch filter's notch frequency and notch parameter. These values are 10.95 and 16.33 respectively as compared to the exact values of 11.18 and 17.79.

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