Correspondence

RC Networks with Single-Component Frequency Control*

The subject of single-component control of oscillators and selective amplifiers, as described in Mr. Clothier's article in the March, 1955, issue of the *PGCT Transactions*, has been of great interest to us. We have come across several networks of this type which, to my knowledge, have not appeared in the literature.

The first network (Fig. 1) is somewhat

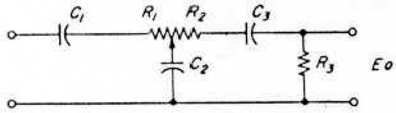

Fig. 1

similar to a Wien bridge, but requires one more condenser. For a null, this network would form two arms of a bridge, the other two being a fixed voltage divider. For this network, if $C_1=C_3$

$$\frac{E_0}{E_{in}}=\frac{1}{1+\frac{C_2}{C_1}+\frac{(R_1+R_2)}{R_3}\left(1+\frac{C_2}{C_1}\right)+j\left\{\omega R_1C_2\left(1+\frac{R_2}{R_3}\right)-\frac{1}{\omega C_1R_3}\left(2+\frac{C_2}{C_1}\right)\right\}}.$$

Notice that the magnitude at peak is independent of the value of R_1 or R_2 as long as R_1+R_2 is constant.

The frequency of the peak is given by

$$\omega^2=\left(2+\frac{C_2}{C_1}\right)\frac{1}{C_1C_2R_1(R_2+R_3)}.$$

By taking the topographical dual and interchanging R's and C's and also input and output, we arrive at the second network (Fig. 2) which uses a differential capacitor.

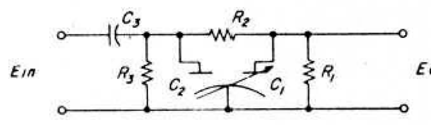

Fig. 2

The expressions for E_0/E_{in} and frequency can be obtained from the above expressions by interchanging R's and C's, but keeping the subscripts the same. (Here R_1 has to equal R_3, and C_1+C_2 must be constant in order to keep the magnitude at peak constant.)

The next network gives a complete null,

Used in GR 1232A Detector →

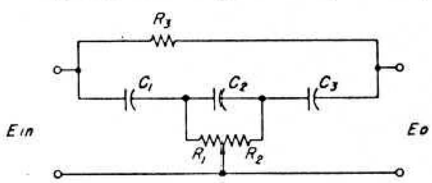

Fig. 3

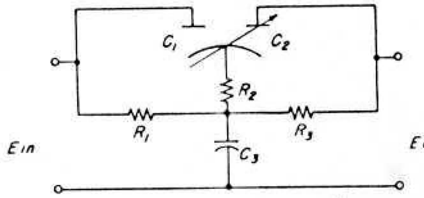

Fig. 4

and yet has a terminal common to input and output. Here if $C_1=C_3$, the null conditions can be written

$$R_1R_2\omega^2=\frac{(C_1+C_2)(R_1+R_2)}{C_1^2C_2R_3}$$
$$=\frac{1}{C_1(2C_2+C_1)}.$$

Since R_1+R_2 is constant, the null conditions are met as R_1R_2 is varied while the null frequency is changed.

The last network (Fig. 4) is the "dual" of Fig. 3, and the null conditions are given by the above expression if the R's and C's are interchanged.

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