A Novel Variable Frequency Sinusoidal Oscillator Using a Single Current Conveyor

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Abstract—**A new active *RC* second-order sinusoidal oscillator using a single second generation current conveyor is described. A single grounded resistor adjusts the circuit for oscillation and a single grounded capacitor controls the oscillation frequency without affecting the oscillation condition.**

Recently an active *RC* second-order sinusoidal oscillator using the second generation current conveyor (CC II) [1] as the active element has been given [2]. The frequency of oscillation is controlled by tuning a single grounded resistor or a grounded capacitor in the circuit. The oscillator circuit, however, requires two opposite polarity current conveyors [2].

In this letter a novel oscillator circuit using a single CC II is described. The oscillation frequency is controlled by tuning a single grounded capacitor without affecting the oscillation condition.

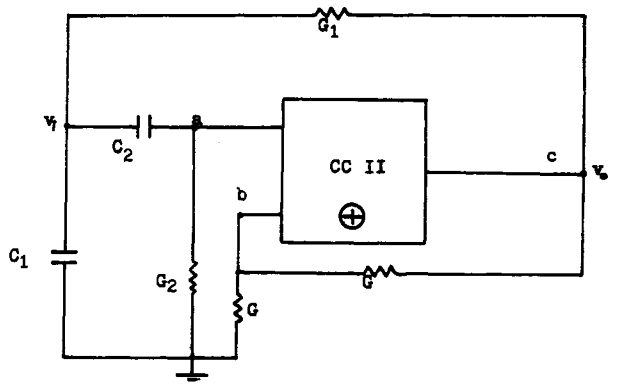

Fig. 1. A novel variable frequency sinusoidal oscillator. The terminal characteristics of the current conveyor are [1] $i_b = 0$, $v_a = v_b$, $i_c = i_a$.

The new sinusoidal oscillator circuit is shown in Fig. 1. By direct analysis the state equations for the circuit are given by

$$\begin{bmatrix} \dot{v}_i \\ \dot{v}_o \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} v_i \\ v_o \end{bmatrix} \tag{1}$$

where

$$a_{11} = -2\frac{G_1}{C_1} \tag{2}$$

$$a_{12} = \frac{G + 4G_1 - G_2}{2C_1} \tag{3}$$

$$a_{21} = -\frac{4G_1}{C_1} - \frac{2G_1}{C_2} \tag{4}$$

$$a_{22} = \frac{G + 4G_1 - G_2}{C_1} + \frac{G + 2G_1 - G_2}{C_2}. \tag{5}$$

The condition for oscillation is given by

$$a_{11} + a_{22} = 0 \tag{6}$$

which implies that

$$G_2 = G + 2G_1. \tag{7}$$

The oscillation radian frequency is given by

$$\omega_o = \sqrt{a_{11}a_{22} - a_{12}a_{21}}. \tag{8}$$

Thus

$$\omega_o = G_1\sqrt{2/C_1C_2}. \tag{9}$$

As can be seen from (7) and (9), G_2 adjusts the circuit for oscillation and the grounded capacitor C_1 controls the frequency of oscillation without affecting the oscillation condition.

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On the Double Nature of Transmission Zeros in Microstrip Structures

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Abstract—**The EM nature of transmission zeros in microstrip structures has been the subject of several discussions. A liquid crystal thermal mapping technique is used for detecting the magnetic field distribution inside rectangular structures at the frequencies of the transmission zeros. In this way a perceptible evidence is given to previous theoretical results, which have pointed out the existence of two types of transmission zeros, called modal zeros and interaction zeros.**

I. INTRODUCTION

In the area of microwave integrated circuits, several investigations have stressed the marked filtering properties of rectangular structures. In particular, the existence of transmission zeros has been pointed out both theoretically and experimentally. Nevertheless, the interpretation of the physical nature of such zeros has been discussed for a long time; several authors seemed to believe that they were due to the excitation of higher order modes of propagation in the wider microstrip section [1]-[4]. A recent theoretical analysis, however, supported by experimental data, has shown the existence of two types of transmission zeros: modal zeros and interaction zeros [5]. A perceptible evidence to such a result is given in the present letter through a liquid crystal technique recently set up [6] for detecting the magnetic field distribution inside microstrip structures. The experiments clearly confirm the double nature of transmission zeros and the condition stated in [5] for their existence.

II. MODAL AND INTERACTION ZEROS

Modal transmission zeros in microwave two-port networks are due to the resonances of these modes of the structure which can be excited only at one port, since they are uncoupled to the other port. This implies that: a) only nonsymmetrical structures[1] present this type of transmission zeros, and b) the frequency of a modal zero coincides with the resonant frequency of the corresponding mode.

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[1] Degenerate structures, i.e., structures with degenerate modes, should be regarded as special cases. Thus, for the sake of brevity, they are not considered here.

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