Current –Mode Oscillator using Single DVCC

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ABSTRACT
A realization of first order current mode oscillator based on differential voltage current conveyor is proposed. This circuit employs only one DVCC and few passive components.

KEYWORDS
DVCC, Oscillator, current-mode circuits.

1. INTRODUCTION
The current-mode circuits have become very popular in realization of analog filters and oscillator due to their wide bandwidth, high slew rate, greater linearity, wider dynamic range, and low power consumption.[1]. The use of current mode active filter is advantageous in high frequency signal processing application. all pass filters can be used for realization of oscillator. Several current mode all pass filters are available in technical journals[2,3,4].

The oscillator play very important role in analog circuit design because they are widely used in communication, signal processing and control system. The oscillator can be implemented in various approaches[5,6]. The differential circuits have the advantage of canceling out unwanted common-mode signal/noise can used in high frequency applications.

Differential voltage current conveyor have high rejection capability to power supply noise, large output dynamic range and reduced harmonics distortions [7].

In this paper, a single DVCC based current mode oscillator employing resistors and capacitors.

2. PROPOSED CIRCUIT
The electrical symbol of differential voltage current conveyor (DVCC) is shown in Fig.1. Its port characteristics can be expressed as follows

\[ V_X = V_{Y1} - V_{Y2}, \quad I_{Y1} = I_{Y2} = 0, \text{And} \quad I_{Z1} = - I_{Z2} = I_X \]  

\[ \begin{bmatrix} V_X \\ I_{Y1} \\ I_{Y2} \\ I_{Z1} \\ I_{Z2} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} V_{Y1} \\ V_{Y2} \\ V_{X} \\ I_{Y1} \\ I_{Y2} \end{bmatrix} \]

Figure.1: Symbol of DVCC

DVCC was first proposed by Pal[7] as modified current conveyor and developed and realized by Elwan and Soliman [8]. The DVCC has the advantages of both of the second generation Current conveyor(CCII)such as large signal bandwidth, great linearity wide range) and differential difference amplifier(DDA) (such as high input impedances and arithmetic operational capability). The DVCC is a versatile building block in such application as analog signal processing, automatic control and instrumentation system where the differential signals are common.

The difference in terminal voltage of Y1 and Y2 is conveyed to the X terminal.

The input current applied to the X terminal is conveyed to the Z+ terminal of same polarity (the polarity is reversed for Z- terminal). The Y1 and Y2 terminals are high impedance terminals while X terminal is low impedance one. The Z1 and Z2 terminals are high impedance nodes suitable for current outputs. The flow direction of the output current follows the input current direction with both currents flowing either into or out of the device. The CMOS realization [8] of DVCC can be used for the oscillator implementation is shown in Fig.2.

Figure 2: CMOS implementation of DVCC

The proposed current-mode DVCC based oscillator is shown in Fig.3

Using one DVCC a oscillator that contains few passive components is implemented and shown in Fig.3

The nodal analysis yields characteristic equation of the proposed oscillator.

\[ S^2 + S \left[ \frac{1}{R_1C_5} - \frac{2}{R_3C_5} \right] + \frac{1}{R_1R_3C_1C_5} \]

which results the condition of oscillation as

\[ \frac{1}{R_1C_5} - \frac{2}{R_3C_5} = 0 \]

\[ R_3 = 2R_1 \]

The frequency of oscillation is
3. SIMULATED RESULT
The proposed oscillator circuit is designed using DVCC. The transfer function of oscillator circuit is mathematically realized the proposed current mode oscillator can be simulated using Pspice to verify the theoretical result. To implement the DVCC active element, CMOS structure of figure 2 can be used.

4. CONCLUSION
In this work a DVCC based current mode oscillator has been presented. The oscillator contains single DVCC and few passive components. Proposed circuit is designed for operation at high frequency and tested using Pspice simulation program. Simulation result agree with theoretical analysis.

5. REFERENCES