ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 7, July 2016

Current Conveyor (CCII) Based Oscillator

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ABSTRACT: In this paper, current-mode based sinusoidal oscillator is presented. This is designed with current mode second generation current conveyor (CCII). The current conveyor (CCII) is based on current mode trans-linear scheme, with independent control of frequency is presented in this paper. The configuration consists of a second-generation conveyor (CCII), and a capacitor that is responsible for better linearity. The proposed oscillator, which utilizes a second generation current conveyor (CCII) as a active element. The frequency of the oscillator can be adjusted with bias current of current conveyor (CCII) circuit. The circuit is designed in 180nm technology in cadence and the supply voltage for oscillator is ±1V.

KEYWORDS: Current mode oscillator**,** Current conveyor (CCII), Bias current.

I. INTRODUCTION

Oscillators are most useful electronic circuits that generates periodic AC waveforms (e.g., sinusoidal, square or triangular). Sinusoidal oscillator of variable frequency has a wide range of applications in the field of telecommunication, signal processing, control systems, measurement system and sensor interfacing, particularly depending on their operating frequency range. A number of oscillator circuits have been designed based on voltage-mode. It is well known that the dynamic range of voltage-mode oscillators is dictated by frequency-dependent gain of operational amplifier. This problem can be solved by current mode (CM) approach, There is a number of different oscillators have been proposed based on current mode approach (CM) approach, under current mode various techniques can be readily seen these techniques are usually the outcomes of processes or function controlled or governed by the current signal instead of well established voltage signals. In present the main focus of researchers is to decrease the number of active and passive components while maintaining wide operating frequency range. The second-generation current conveyor has become very popular because of its high performance coupled with functional versatility. It has led to its wide application for implementation of high performance electronic functions operating either in voltage mode or current mode.

II. CURRENT CONVEYOR

In 1968 sedra and smith first introduced current conveyor named as first generation current conveyor (CCI). Current conveyor can provide better gain-bandwidth products than compare to op-amps. There is three generation of current conveyor named as first generation current conveyor (CCI), second generation current conveyor (CCII) and third generation current conveyor (CCIII).

Second generation current conveyor (CCII):

Second generation current conveyor (CCII) relies upon the ability of the circuit to act as a voltage buffer between its inputs and the ability to convey current between two ports at extremely different impedance levels.

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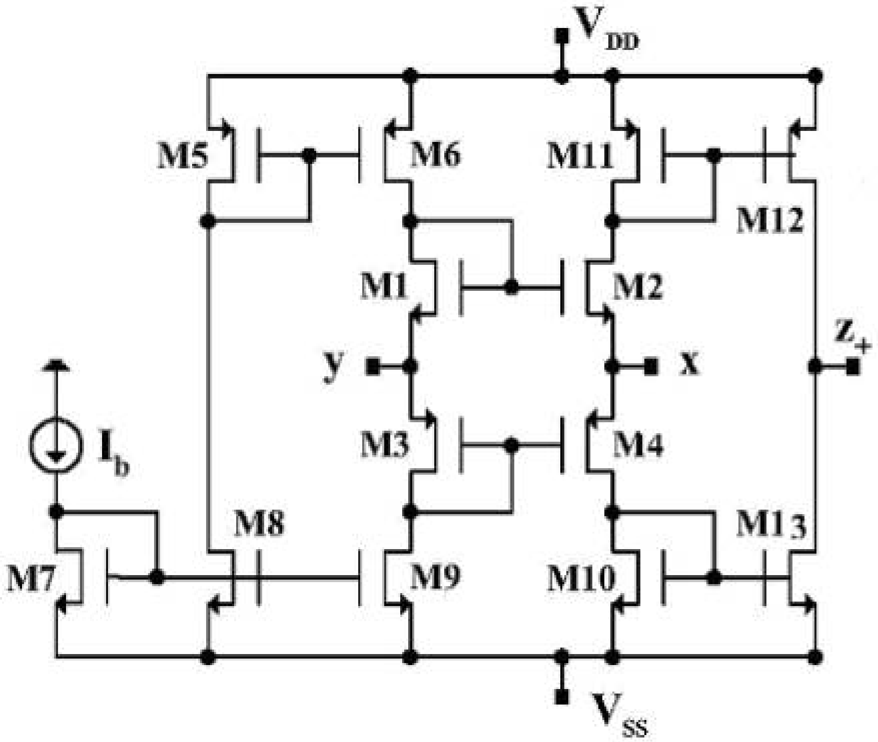

Fig.-1 Translinear loop Current Conveyor (CCII)

Fig. 1 shows the symbol of CCII, characteristics of CCII can be described as:

$$V_X = V_Y, \quad i_y = 0, \quad i_z = i_x.$$

The output current i_z depends on input current $i_{x,}$ which may be directly injected by applying voltage at X node, or by copy the input voltage from terminal Y. The second generation current conveyor (CCII), which shows large dynamic range, wide bandwidth, high linearity, possibility of design using low power consumption and simple analog circuit designing.

Translinear loop implementation in current conveyor:

Translinear loop implementation allows the design of high performance circuit that extend both bandwidth and thermal stability. Translinear loop comprises of two pmos and two nmos transistor as shown in fig.-2. This cell today appears for high speed current mode application as it can be driven directly by current with bipolar value and enables a virtual ground to be obtained without feedback. Therefore it is commonly used as input stage of much high performance analog function such as current conveyor.

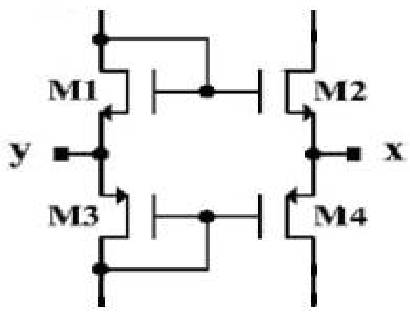

Fig.-2 translinear loop implementation

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III. PROPOSED OSCILLATOR

Second generation current conveyor is the basic building block of our circuit. It is possible to design oscillator with single current conveyor. CCII oscillator is basically based on translinear loop scheme. Oscillator can be easily design with second generation current conveyor (CCII) and a capacitor. The oscillator using CCII is shown in fig.2 which is derived with trans-linear scheme, in

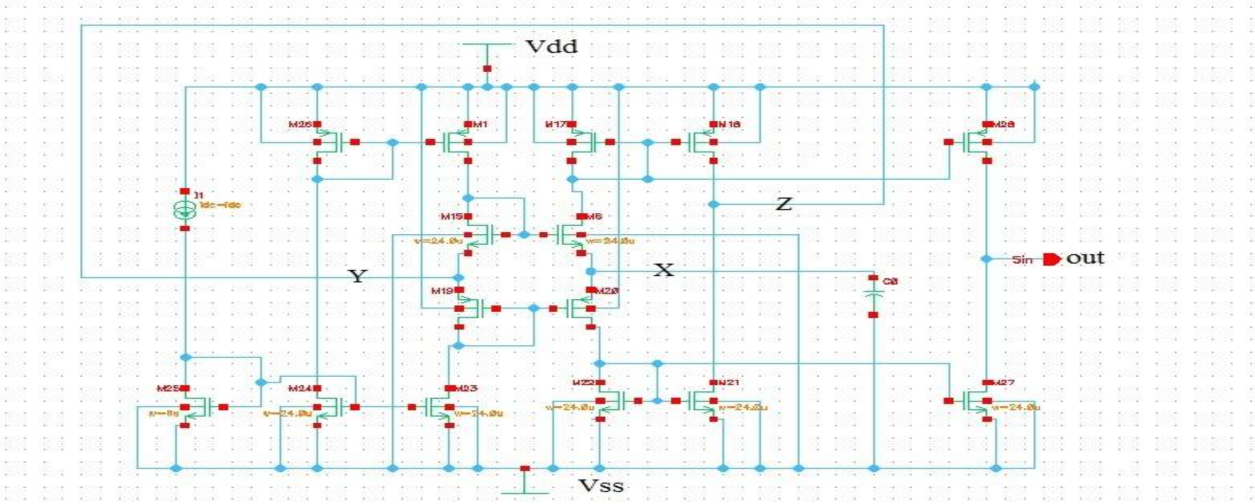

Fig.3 CCII Oscillator

which z terminal is feedback to y terminal of CCII and a capacitor is connected to x terminal of CCII which is constrained better linearity and terminal out provide us sine wave. Here the current conveyor operating at low voltage supply ±1V.

IV. SIMULATION RESULTS

The circuit in fig.-3 is simulated in cadence with spectre simulation tool and the supply voltage for the circuit is 1V and the bias current is varied 20uA to 80uA. When the dc bias current is in the range 40uA to 80uA the circuit provides better oscillations. The output of the current mode oscillator gives better sinusoidal wave shown in fig.4.

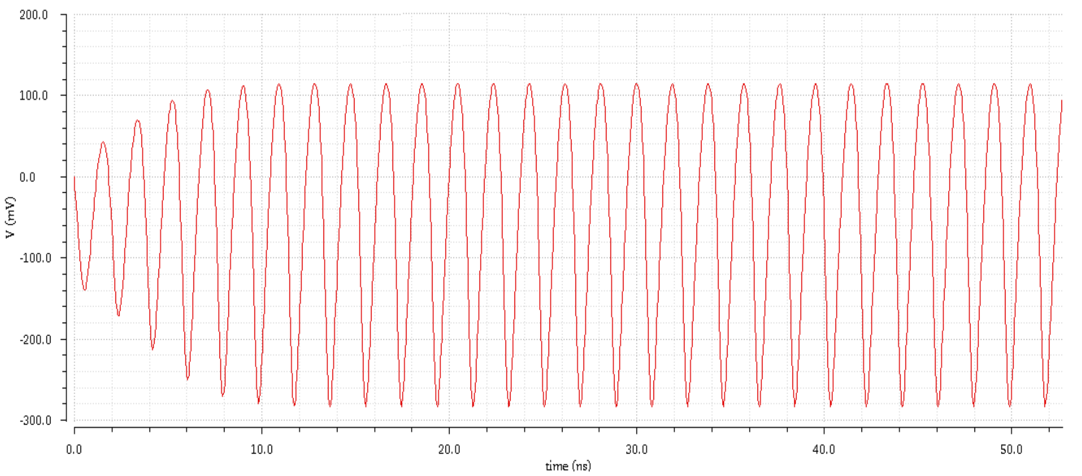

Fig.-4 Oscillating Frequency

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Fig.-5 shows the graph between dc bias current (I_{dc}) and frequency. It is also observed that as the dc bias current (I_{dc}) of the current conveyor circuit is varied the frequency is also varied this variation is shown in fig-5, from the graph It is clear that as bias current increases (I_{dc}) the frequency is also increases.

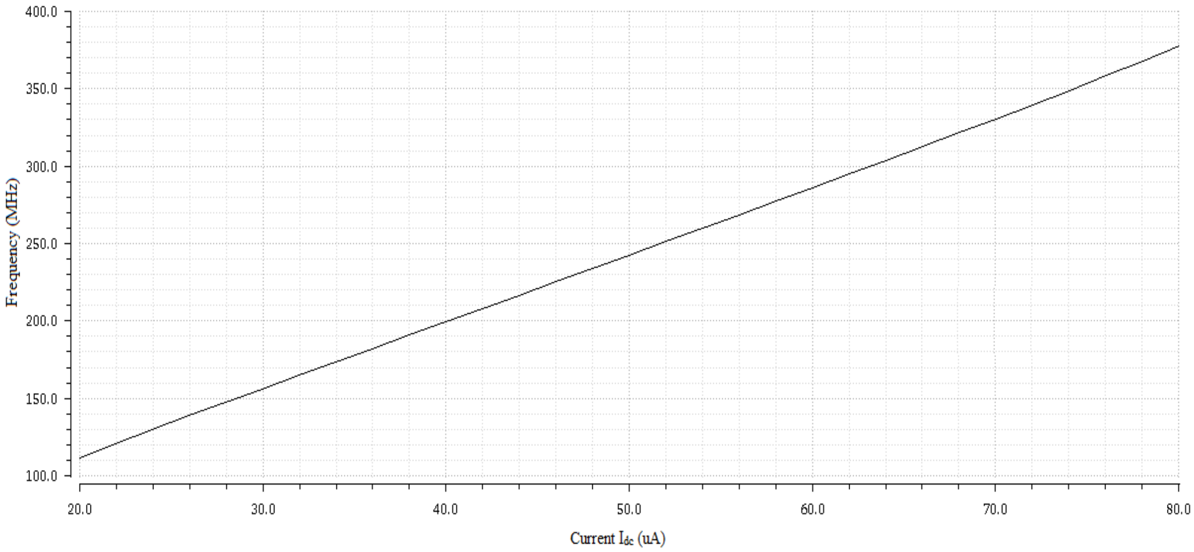

Fig.-5 Bias current (I_{dc}) Vs Frequency

The power consumption is also an important parameter for any design circuit, power dissipation in the circuit is lies between 3.3mW to 5.5mW as bias current increases the power dissipation increases.

V. CONCLUSION

The simulation results showed that the proposed function generator have better linearity and the frequency range is also improve and can varies from 112MHz to 375MHz and passive component is reduced. It is also seen that oscillation frequency is changed according to the bias current and in addition it does not depend on supply voltage. The function generator gives better response when its bias current is in the range 40uA to 80uA. The power dissipation is less as compare to previous and maximum power dissipation is 5.5mW.

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