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Filter realization using second generation current conveyor

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ABSTRACT- Active filter using single op-amp have been in use from number of years and recently they have been in use in the wireless Trans receiver, utilizing a differential difference amplifier or fully differential voltage buffer. Active filters that are based on single OTA with single output or multiple outputs, in both the current mode as well as voltage mode have been most widely used. Single CCII filter design has also draws the attention of many people.

Keywords- active filters, current conveyor, current mode filter

I INTRODUCTION

Current conveyors have proved themselves to be functionally flexible and accomplished and are now it has been briskly acquiring acceptance as the practical building block in manner as the theoretical building block. The high performance implementations of current conveyors has become a challenge to successfully long established voltage operational amplifier circuits in the fields like active filters, oscillators and amplifiers, in the last five years. The second generation current conveyor has proved to be more useful than CCI. The second generation current conveyor is one of the most versatile current mode building block as it has been used in wide range of applications and several circuit realizations has been done for it implementation.

II APPLICATIONS OF CURRENT CONVEYORS

- In the field of analog computation, Current conveyors can be used through various methods, example current summer, weighted current summer, current amplifier, current differentiator and current integrator.
- Current conveyors are basically used as effective building blocks in order to realize countless current mode active filters. A universal filter is most famous analog filter as it can be able to determine standard functions like low pass,
- high pass, band reject, band pass and all pass.
- They are helpful in the active network synthesis also.
- Current conveyors can be used in number of configurations, i.e voltage controlled voltage source, current controlled voltage source, voltage controlled current source, current controlled current source, gyrator etc.
- Filters and oscillators designing can be done very effectively with the help of current conveyor.

III FILTER REALIZATION USING CURRENT CONVEYOR

The current conveyor becomes very attractive in the implementation of active filters due to number of advantages that current mode operation has over the conventional voltage mode operation. We are demonstrating a current mode active filter using second generation current conveyor. In the simulation of second order active filters the RLC shunt circuit is a very useful circuit. The method of simulation utilize either the ideal inductors by means of gyrators or lossy inductors or shunt LC circuits and use at least two current conveyors or a single current conveyor and additional active devices.

The figure below shows the current to voltage low pass filter using second generation current conveyor.

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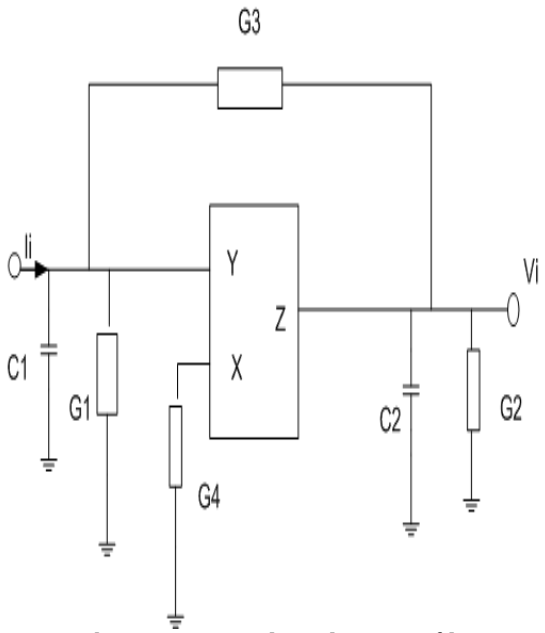

Fig 1. The current to voltage low pass filter using single CCII

This filter incorporates all the finite CCII capacitance and resistances and also offers both inverting and non-inverting outputs.
The suggested current to voltage low pass filter using single second generation current conveyor is shown in figure 3.9 below.

IV TRANSFER FUNCTION

Its transfer function can be derived as
$Vo/ Ii = (G3 – G4) / (C1C2s^2 + C1G2 + G3)s + C2(G1+G3)s + G1G2 + G2G3 + G3G4)$

The polarity of the gain can be controlled only by the help of G3 and G4. The non-inverting function can be achieved by G3>G4 and by G3<G4 the inverting function can be achieved. The normalized frequency is given by $w_o = 1$. The sensitivities w_o and Q of the filter are very low.

V FILTER CIRCUIT USING INTERNAL CIRCUIT OF CCII

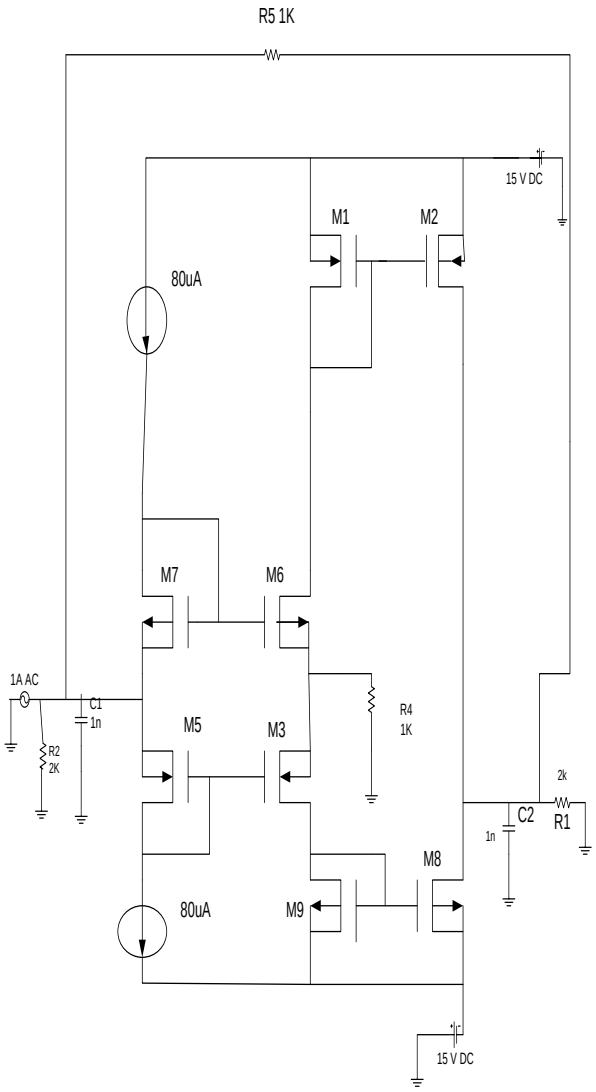

Fig 2. Current to voltage low pass filter circuit

The above filter circuit is formed using the internal realization of second generation current conveyor as given below. To ensure the correct operation the bias current I_{bias1} and I_{bias2} have to be equal. In first generation push-pull conveyor, the quiescent current is set directly to the I_B with the help of two current sources. Here the current that flows through X is divided nonlinearly into the signal path either through NMOS or through PMOS current mirror which are summed up at the port Z.

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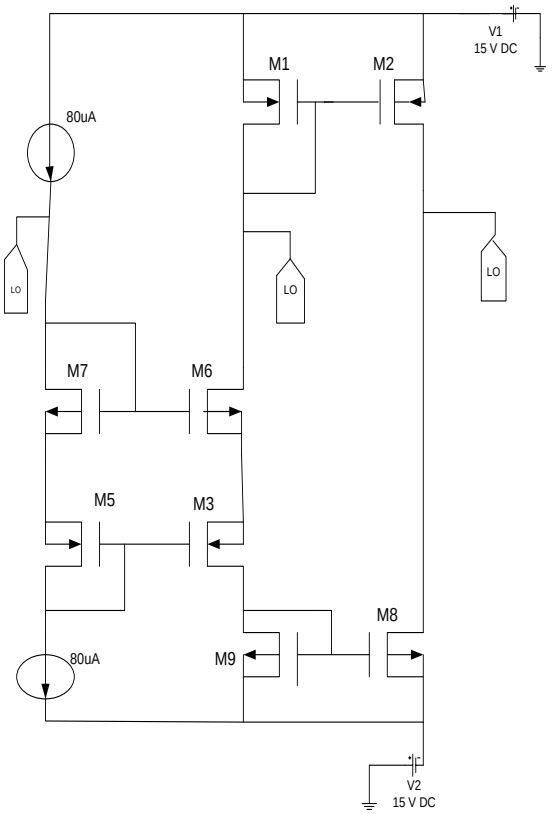

Fig 3. Second generation current conveyor circuit.

VI SIMULATION RESULT

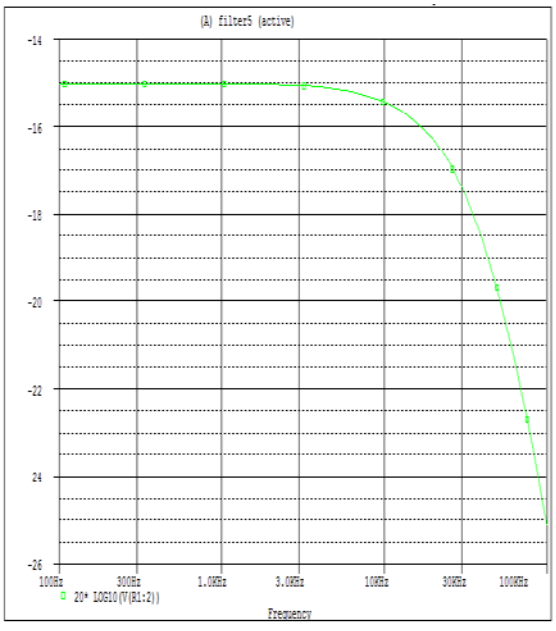

Fig 4. Simulated result of current to voltage low pass filter circuit with a cut off frequency of 35.55 kHz.

VII CONCLUSION

It can be used in high frequency applications because of its higher bandwidth. Power consumption can also be reduced by the usage of CCII. Moreover it provides a delicate approach to make current conveyor to be relevant for the use in low voltage circuits which are appropriate for now a days diminishing power supply for VLSI circuits. FILTER circuits utilize CMOS technology that results in the fully integrated conveyors. Current mode filter topology which uses dual output CCII, which can realize several types of low pass, band pass and high pass filters. More importantly the filters are useful for the purpose of data conversion and can filter the sampled data. It can also provide the interfacing between current mode and voltage mode systems.

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