

Area Efficient Current Mode all Passes Filter and Notch Filter using Single CDDBA

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Abstract - In the proposed work, A single current differencing buffer amplifier (CDDBA) in the current mode with application of second order notch filter and all pass filter is presented. The proposed circuit is suitable to realize the proposed operation by using of single CDDBA with the current processing application of filter design also we have driven the performance of CDDBA and area efficiency. A second order all-pass filter and notch filter are designed to define application in current mode processing with the single CDDBA. The SPICE simulation results for frequency responses are incorporated to verify the theory. The work is done on 180nm technology.

Keywords- CDDBA, Orcade Pspice, Filter etc.

I. INTRODUCTION

The work is based on CDDBA. In the proposed work we use a single CDDBA to demonstrate the filter design for reducing the size of the chip. The basic study during the work, main focused was to simulate the all pass filter and notch filter using the single CDDBA performs in current mode with the help of Pspice software. To performing the proposed work in the software we have to focus on the CMOS realization circuit. In order to work firstly we have find the CDDBA simulation in Pspice then design the proposed circuit for simulate the work which is gone through the relevant and satisfied all the condition of the design. During the work the main finding occurred that by using of a single CDDBA, the all pass filter and the notch filter can be realize in Pspice simulation. The main focused was to reduce the size of chip to perform the relevant and fulfillment of simulation. The main finding during the work to reduce the chip area and make the circuit efficient and feasible. We also focused on the current mode because current mode works in a similar fashion, except it limits and regulates the output current of the supply to the desired level. When the supply runs in current mode, the supply provides a constant current into a variety of load voltage conditions including a short circuit. A current source is generally modeled as providing a very high output impedance of the supply. In the proposed work the significance that while working on the task it must be clarify that only a single CDDBA is being used during the simulation and the work is done in 180nm technology Therefore, current-mode approach has been increasingly recognized as a way to overcome the opamp drawbacks and to realize high speed systems. At the beginning, operational amplifiers were the un-avoided building blocks for analog circuit design. Unfortunately, their limited performance such as bandwidth, slew-rate etc. leads the analog designer to search other possibilities and other

building blocks [3]. All pass filter are generally used for phase shifting keeping the amplitude of input signal constant over the given frequency ranges, another application based on notch filter design ,in this paper , The concept of the current conveyor was first introduced by Smith and Sedra in 1968. It was called the first-generation current conveyor (CCI) which is a 3-terminal building block device. Since then, the area of current mode circuits has progressed very fast and several thousand research papers have been published in this exciting area so far. A new active element termed as operational trans-resistance amplifier (OTRA) (commercially available as Norton amplifier 5, 44) along with its CMOS implementation was introduced by Chen, Tsao and Chen in 1992. On the different side, another new building block known as current differencing buffered amplifier (CDDBA) was introduced by Acar and Ozoguz in 1999.. CDDBA is also known as differential current voltage conveyor (DCVC). CDDBA is basically a general form of OTRA as an universal element. Current differencing unit (CDU) and the voltage unity-gain buffer are contained into the internal structure of the CDDBA. CDU is a current conveyor of the MDCC type. A Current controlled CDDBA (CC-CDDBA) was presented by Maheshwari and Khan in 2004. A number of active device are also proposed with modification of CDDBA as CCCDDBA, ZC-CDDBA (Maheshwari and Khan, 2004), (Bashir and Shah, 2012). Apart from them still the work is going on to use the CDDBA circuits for different low voltage and high gain applications. In this paper a new improved circuit with single CDDBA has been presented to realized the second order all pass filter and notch filter with CMOS circuit, which presented the area efficiency and high performance. To demonstrate the performance of the CDDBA circuit, a second order all pass filter and notch filter. The giving implementation is performed only in the CMOS circuitry which is contains only MOS transistor. The area of performance in next section includes the PSPICE

simulation characteristics of notch filter and all pass filter second order. The simulation shows that the given circuit of CDBA is feasible a good performance and the result out comes for the second order filters are good agreement with the theory.

II. LITRECTURE SURVEY

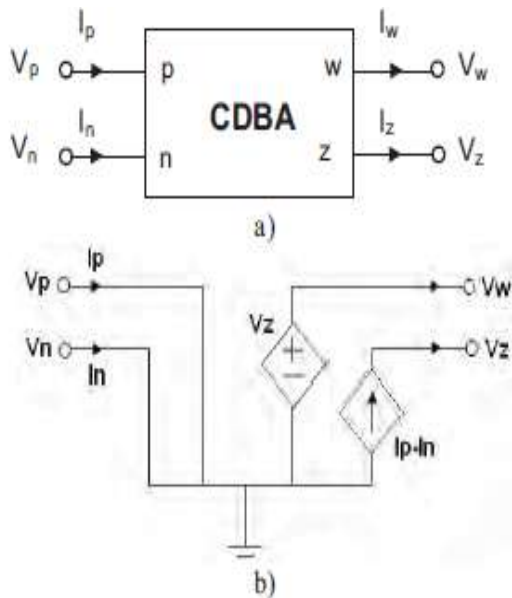
Firat Kaçar1, Serdar Menekay Realization of a CMOS Current Differencing Buffer Amplifier and Its Filter Application In this paper, a CMOS realization of the current Differencing buffer amplifier (CDBA) in the low voltage is presented. The circuit is suited for CMOS implementation. A first order all-pass filter circuit was chosen as an application example in order to demonstrate the performance of the CDBA A new current differencing buffer amplifier, CDBA is Presented. A new and simple CMOS realization of this element is given. An application example of a voltage-mode all-pass filter employing the proposed CMOS CDBA realization has been presented.

Firat KAÇAR, Yasin ÖZCELEP worked on the CDBA Based Voltage-Mode First-Order All-pass Filter Topologies with Five new configurations realizing canonical first-order voltage-mode all-pass filter configurations using a single current differencing buffer amplifier (CDBA). In this work, five CDBA based voltage-mode first order all-pass filter configurations are presented. All proposed circuits use only a single CDBA. However some of them use five passive components, some of them use four passive components. PSPICE simulations were performed with a CMOS realization of the CDBA. Simulation results show that filter characteristics are in good agreement with theory. Gagandeep Kaur and Mohammad Ayoub Khan *Second Order Multi-Mode Notch/All pass Filter using Single Current Differencing Buffered Amplifier*, This worked presents a current differencing buffered amplifier as an active element for analog signal processing which support, in comparison to conventional operational amplifier not only the voltage mode But also the current-and mixed-mode operations. This work showed, multimode notch filter using single CDBA has been done. Firat KAÇAR1, Abdullah YEŞİL1 and Abbas NOORI *New CMOS Realization of Voltage Differencing Buffered Amplifier and Its Biquad Filter Applications* In this work, new biquad filter configuration using a recently introduced active element, namely Voltage Differencing Buffered Amplifier (VDBA), is proposed. This block has high impedance input terminals and low impedance output terminal, providing advantages at voltage mode circuit, In this work, a new CMOS implementation of voltage differencing buffer amplifier is presented and two proposed voltage-mode three-input single-output biquad filters containing two VDBAs and two or three passive components.

Both filter circuits realize all filter configurations and natural frequency can be tuned electronically with bias voltage. Sheikh Ajaz Bashir*, Nisar Ahmed Shah *Voltage Mode Universal Filter Using Current Differencing Buffered Amplifier as an Active Device* in this work Integrated filter circuit design resulted in desire for replacement of Inductors by active elements like Operational Amplifiers which led to the introduction of active filters. Active filter design has evolved over a period of time. Starting with OP AMPs, we have witnessed phenomenal growth of active component usage in filter design and development catering to varying requirements, In this work, VM TISO multifunction filter involving a single CDBA is introduced. The proposed circuit is able to realize Low Pass, High Pass, Band Pass, All Pass and Notch function as well. Besides employing a single CDBA, there are four resistive and two reactive components in the circuit block. Mehmet SAGBAS *Design of CDBA-based active polyphase filter for low-IF receiver applications* in this work a novel first-order active-RC polyphase filter section, using current differencing buffered amplifiers (CDBAs), is presented. The section uses 6 resistors, 2 capacitors, and 2 CDBAs. The transfer function of the proposed section has a single pole and optionally a single zero, An active polyphase filter section implemented with a CDBA was presented. It used 6 resistors, 2 capacitors, and 2 CDBAs. Although matching of the used resistors was required for the realization, this is a common feature in many circuits and can be handled easily. J. K. Pathak1 , A. K. Singh2 , Raj Senani *New Multiplier/Divider Using a Single Cdba* A new multiplier-divider circuit using a single Current Differencing Buffered Amplifier (CDBA) and only six MOSFETs has been presented. The proposed circuit has the advantage of simultaneously realizing a multiplier and divider without changing the circuit topology, the presented singleCDBA-based configuration uses six MOSFETs but has the advantage of realizing both multiplier and divider functions simultaneously. SPICE simulation results based on CMOS CDBA and MOS transistors in 0.35um CMOS technology. Vishal Ramola, Saurabh Mishra *Design of CCCDBA Based Voltage Mode Differentiator and Integrator* In this paper a voltage mode differentiator (First order high pass filter) and voltage mode integrator (First order low pass filter) have been proposed by using current controlled current differencing buffered amplifier (CCCDBA) The voltage-mode building blocks of differentiators and integrators (both lossy and lossless) have been presented which can be used to form active filters. These building blocks are quite helpful in the realization of active filters for frequencies of more than 1.0MHz. These filters operate for voltage as low as 2.5V or less.

III. CIRCUIT DESCRIPTION OF CDDBA

The circuit symbol of the Current Differencing Buffered Amplifier (CDDBA) is shown in Fig. 1a, where p and n are input, w and z are output terminals[4]. The equivalent circuit CDDBA gave below.



1. a) Symbol of the CDDBA b) Equivalent circuit of CDDBA

Ideal current and voltage characteristics of the CDDBA can be Described by $V_p = 0, V_n = 0, I_z = I_p - I_n, V_w = V_z$. (1)By taking the non-idealities of the CDDBA into account, the Above terminal equations can be rewritten as $V_p = 0, V_n = 0, I_z = "pI_p - "nI_n, V_w = #V_z$, (2) Where "p and "n are the current gains, and # is the voltage gain. These gains can be expressed by using the current tracking errors $|\$p| \ll 1$ and $|\$n| \ll 1$ and the voltage tracking error $|\$v| \ll 1$ as "p = 1 - \$p, "n = 1 - \$n, # = 1 - \$v. (3)According to the equations mentioned above and equivalent circuit shown in Figure 1, the current through z-terminal is the difference of the currents through p-terminal and n-terminal, hence, the z-terminal is called current output; p- and n-terminals are non-inverting and inverting input terminals, respectively. Since the voltage at the w-terminal follows the voltage of z terminal, it is called voltage output. Note that the input terminals, through which ip and in flows, are internally grounded, where ideally the input impedance of the terminals n are internally zero[1,5].

IV. CMOS RELIZATION

The proposed CDDBA consists of two principal blocks: a current differencing circuit which has finite input resistances and a voltage buffer circuit. The proposed realization of the CDDBA in a CMOS configuration is shown in Fig. 2.

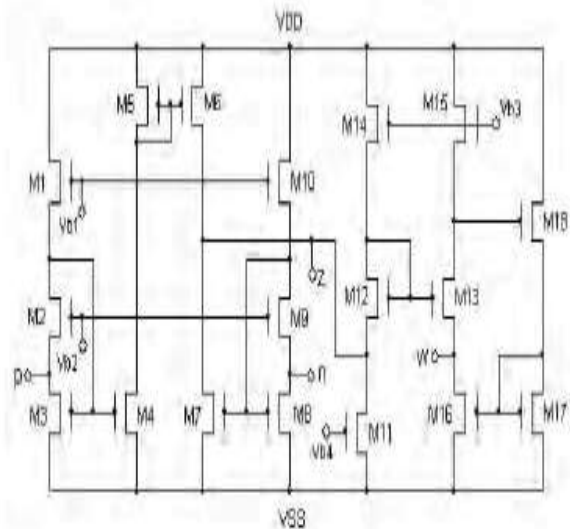


Fig. 2. A CMOS implementation of the CDDBA

The transistors M1 to M10 form the input stage of the CDDBA element. In the current mirrors of the input stage, flipped voltage followers (FVF) [23] are used. Feedback in FVF results in very low input resistances at the input terminals. Input resistance of the p and n terminals can be given using the output resistance of FVF. In the circuit, to construct the current mirrors, outputs of FVF are used as inputs of CDDBA. M2, M3 and M8, M9 are FVF transistors. The flipped voltage followers, input resistances of both p and n terminals are found as 25ohm.

V. PROPOSED WORK

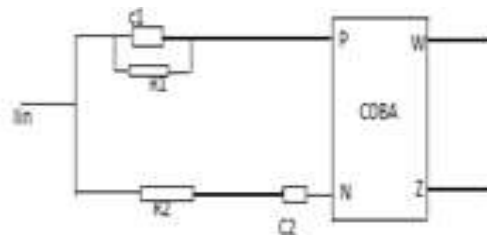


Fig:3 proposed circuit for second order notch filter ,all pass filter

$$I_{in}/I_o = \frac{S^2 + S(1/R_1C_1 + 1/R_2C_2 - 1/R_2C_1) + 1/R_1R_2C_1C_2}{S^2 + S(1/R_1C_1 + 1/R_2C_2 + 1/C_1R_2) + 1/R_1R_2C_1C_2}$$

If $1/R_2C_1 = 2/R_1C_1 + 2/R_2C_2$

The natural frequency ω_0 and quality factor Qo for the notch filter can be expressed

$$\omega_0 = \sqrt{\frac{1}{C_1 C_2 R_1 R_2}}$$

$$Q = \frac{3 \sqrt{C_1 C_2 R_1 R_2}}{4 (C_1 R_1 + C_2 R_2)}$$

All-pass filters are one of the most important building blocks of many analog signal-processing applications and therefore have received much attention. They are generally used for introducing a frequency dependent delay while keeping the amplitude of the input signal constant over the desired frequency range. Other types of active circuits such as oscillators and high-Q band-pass filters are also realized by using all-pass filters.

1. The selected parameter for the notch filter in the giving circuit $R_1=2k$ $C_1=1nf$ $R_2=1k$ $C_2=2nf$ by putting these value in the simulation the notch filter curve is lay down near about 100 KHz, it is verified that by using second order filter a single CDDBA notch filter can be realize.

TABLE 1 parameter for notch filter

Transistor	W(u)/L(u)
M1,M2,M7,M8,M9,M10	150u/1u
M3,M4	350u/.19u,500u/1u
M5,M6	2000u/.1u,100u/2u
M11,M12	4u/2u
M13,M14,M17,M18	5u/1u
M15,M16	100u/1u
M19,M20	20u/1u,200u/1u

2. The selected parameter for realize the second order all pass filter in the giving circuit $R_1= 12Kohm$ $C_1= 5Pf$ $R_2 =2Kohm$ $C_2= 30Pf$ by putting these value in the simulation the second order all pass filter is started decay after 100 KHz , it is verified that by using a single CDDBA second order all pass filter can be realize.

TABLE 2 parameter for all pass filter

Transistor	W(u)/L(u)
M1,M2,M4,M7,M8,M9,M10	150u/1u
M3	1000u/.18u
M5,M6	1000u/1u
M11,M12	4u/2u
M13,M14,M17,M18	5u/1u
M15,M16	100u/1u
M19,M20	20u/1u,200u/1u

VI. PSPICE WAVE FROM AND RESULT

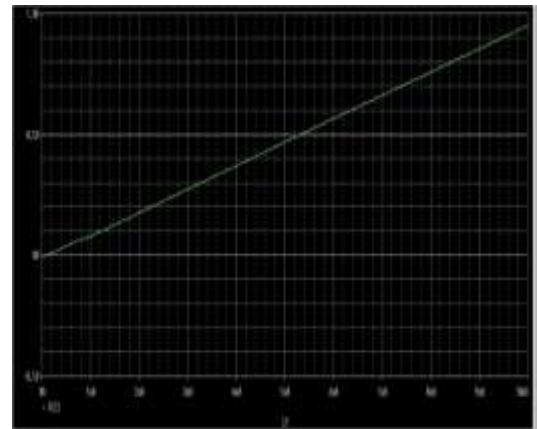


Fig:- waveform of z terminal of CDDBA

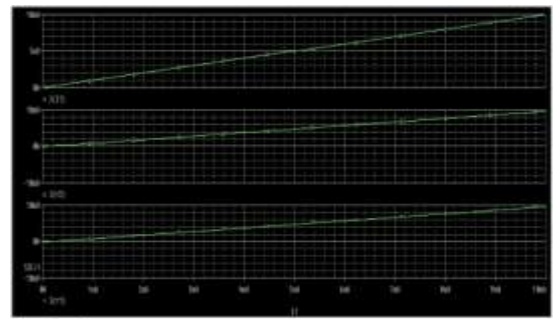


Fig- waveform of CDDBA

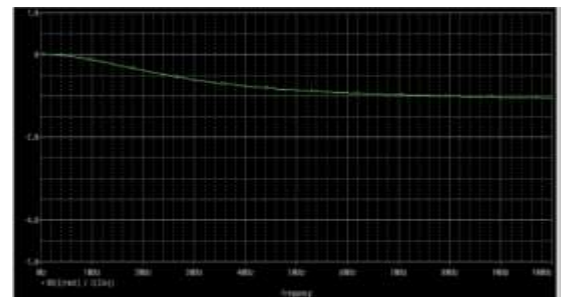


Fig- waveform of second order all pass filter

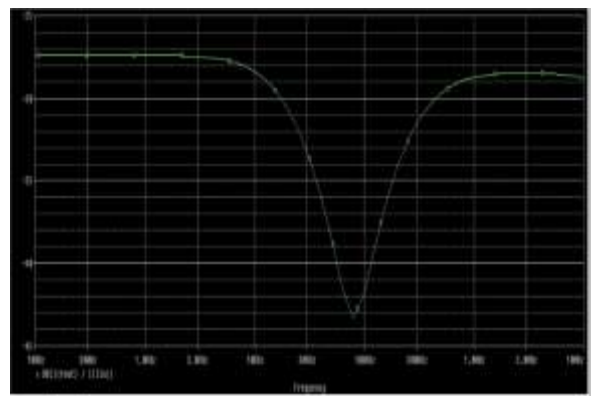


Fig- waveform of second order notch filter

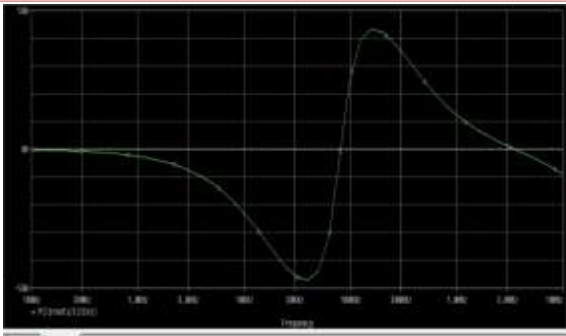


Fig - waveform of phase shift of notch filter

VII. CONCLUSION

CDBA, current differencing buffered amplifier, is a multi terminal active component with two inputs and two outputs. The CDBA is simplifying the implementation, free from parasitic capacitances and it is able to operate in the frequency range of more than hundreds of KHz. All-pass filters, and notch filter are one of the most important building blocks of many analog signal-processing applications and therefore have received much attention. They are generally used for introducing a frequency dependent delay while keeping the amplitude of the input signal constant over the desired frequency range. A new current differencing buffer amplifier, CDBA is presented with the application of all pass filter and notch filter in current mode. The selected parameter for the notch filter in the giving circuit $R1=2k$ $C1=1nf$ $R2=1k$ $C2=2nf$ by putting these value in the simulation the notch filter curve is lay down near about 100 KHz, it is verified that by using second order filter a single CDBA notch filter can be realize and the second circuit parameter for realize the second order all pass filter in the giving circuit $R1= 12Kohm$ $C1= 5Pf$ $R2 =2Kohm$ $C2= 30Pf$ by putting these value in the simulation the second order all pass filter is started decay after 100 KHz , it is verified that by using a single CDBA second order all pass filter can be realize. A new and simple CMOS realization of this element is given. An application example of a voltage-mode all-type filter and notch filter showing the proposed CMOS CDBA realization has been presented. ORCAD PSPICE simulations were performed showing the general waveform with a CMOS realization of the CDBA and its filter application. A second order all-pass filter, notch filter circuit is chosen as an application example in order to showing the performance of the CDBA in current mode operation. The feasibility of the proposed first-order all-pass filter is illustrated. Simulation results show that filter characteristics are in good agreement with theory.

VIII. REFERENCES

- [1] Firat Kaçar1, Serdar Menekay2 Realization of a CMOS Current Differencing Buffer Amplifier and Its Filter

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- [2] Firat KAÇAR, Yasin ÖZCELEP *CDBA Based Voltage-Mode First-Order All-pass Filter Topologies* F.KAÇAR AND Y. ÖZÇELEP / IU-JEEE Vol. 11(1), (2011), 1327-1332
- [3] Gagandeep Kaur and Mohammad Ayoub Khan *Second Order Multi-Mode Notch/Allpass Filter using Single Current Differencing Buffered Amplifier* World Applied Sciences Journal 16 (Special Issue on Recent Trends in VLSI Design): 92-97, 2012 ISSN 1818-4952 © IDOSI Publications, 2012
- [4] Firat KAÇAR1, Abdullah YEŞİL1 and ABBAS NOORI *New CMOS Realization of Voltage Differencing Buffered Amplifier and Its Biquad Filter Applications* RADIOENGINEERING, VOL. 21, NO. 1, APRIL 2012
- [5] Sheikh Ajaz Bashir*, Nisar Ahmed Shah *Voltage Mode Universal Filter Using Current Differencing Buffered Amplifier as an Active Device Circuits and Systems*, 2012, 3, 278-28 <http://dx.doi.org/10.4236/cs.2012.33038> Published Online July 2012 (<http://www.SciRP.org/journal/cs>)
- [6] Mehmet SAGBAS, "Design of CDBA-based active polyphase filter for low-IF receiver applications *Turk J Elec Eng & Comp Sci*, Vol.19, No.4, 2011, c TUB" *ITAK* doi:10.3906/elk-0912-337
- [7] J. K. Pathak1 , A. K. Singh2 , Raj Senani., New Multiplier/Divider Using a Single Cdba "American Journal of Electrical and Electronic Engineering, 2014, Vol. 2, No. 3, 98-102 Available online at <http://pubs.sciepub.com/ajeee/2/3/7> © Science and Education Publishing DOI:10.12691/ajeee-2-3-7AD844 current feedback op-amp", Data Sheet.
- [8] Vishal Ramola, Saurabh Mishra "Design of CCCDBA Based Voltage Mode Differentiator and Integrator *UACEE International Journal of Advances in Electronics Engineering Volume 2: Issue 3 ISSN 2278 - 215X (Online)*.", *ECTI-CON 2007 The 2007 ECTI International Conference*.