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Because of the need of CM operation, it is worthwhile to convert the V-M circuits into C-M circuits. Current-mode (CM) filters are attractive because of their wider bandwidth, higher slew rate, wider dynamic range and lower power consumption compared to voltage-mode (VM) component. However, a large number of op-amp (OA)-based VM circuits with excellent performance and their elegant realization procedures were put forward in the past. It is, therefore, worthwhile to convert them into CM circuits. FTFN (Four terminal floating nullor)[8], CC (current conveyor) and CFA (Current Feedback Amplifier), current differencing buffered amplifier (CDBA), and operational trans-resistance amplifier (OTRA) based CM circuits have received considerable attention in many signal processing applications, particularly, the CFA-based circuits are attractive due to the high slew rate and bandwidth independent of closed loop gain.[5]

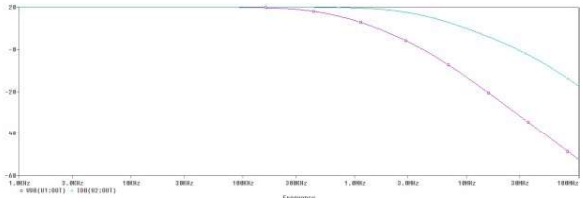

Fig.2.Gain-Bandwidth in-dependency

The BJT based CFA is shown in figure 3. There is buffer between the non inverting input terminal 2 and the inverting input terminal 3.

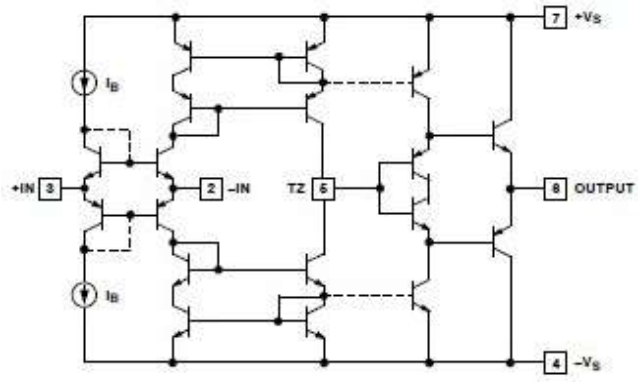

Fig.3.BJT Based CFA

Also, CFA has both the output i.e. in voltage as well as in current form. In this paper, CFA based CM receiver is derived.

A. Current Feedback Amplifier

The terminal characteristics of the current feedback amplifier (CFA) also known as current feedback operational amplifier (CFOA) are:

$$\begin{bmatrix} V_x \\ I_y \\ I_z \\ V_w \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} I_x \\ V_y \\ V_z \\ I_w \end{bmatrix}$$

On the output side, there is a current-controlled voltage source of the strength Z where Z is the forward dynamic transfer impedance of the device (modeled as the parallel combination of R_τ and C_τ) and I is the current following out of the inverting input terminal. For an ideal CFA shown in Fig. 4, R = 0 and Z = ∞. The CFA was released by Analog Devices as early as in 1984[3-4]. IC LM 675 is used for this purpose as it has wider bandwidth of 65 MHz which is comparable to CFA AD 844. The simulation result is shown in figure 8.The total power consumed by VM receiver circuit is 291 mW. Using VM to CM transformation technique [2] here, the input to the modulator is taken from the voltage output terminal (w terminal). The total power consumed by CM transmitter circuit is 123 mW. If the currents are taken as input to the modulator from the z terminal of CFA. The Sallen key Band pass filter are used with two different frequency which receive frequency from transmitter. Then rectified output of the signal which compare through comparator. Design value is 1MHz.

III. MOSFET BASED CFOA

By using proper Aspect ratio we have converted BJT based CFA into CFOA MOSFET.180 nanometer technology used.

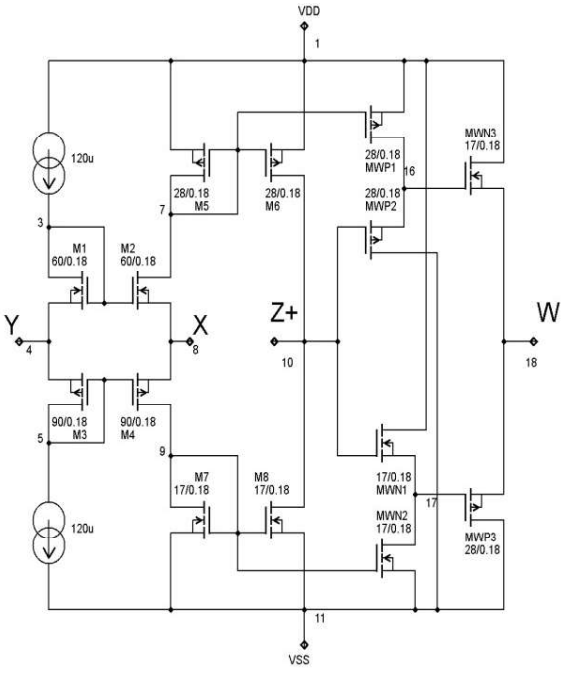

Fig.4.MOSFET based CFA

Code for CFOA

```
*CFOA_AD844+
*.....VSS
*.....VDD|
*.....W  | |
*.....Z  | | |
*.....X| | | |
*.....Y| | | | |
.SUBCKT CFOA_AD844+ 4 8 18 10 1 11

.include p18_cmos_models_tt.inc
*MOSFET CIRCUIT
M1 3 3 4 4 nmos w=60u l=0.18u
M2 7 3 8 8 nmos w=60u l=0.18u
M3 5 5 4 4 pmos w=90u l=0.18u
M4 9 5 8 8 pmos w=90u l=0.18u
M5 7 7 1 1 pmos w=28u l=0.18u
M6 10 7 1 1 pmos w=28u l=0.18u
M7 9 9 11 11 nmos w=17u l=0.18u
M8 10 9 11 11 nmos w=17u l=0.18u
*w section********** MWP1
16 7 1 1 pmos w=28u l=0.18u MWP2 11
10 16 16 pmos w=28u l=0.18u MWN1 1
10 17 17 nmos w=17u l=0.18u MWN2 17
9 11 11 nmos w=17u l=0.18u MWN3 1
16 18 18 nmos w=17u l=0.18u MWP3 11
17 18 18 pmos w=28u l=0.18u
*supplies
Ibias1 1 3 120u
Ibias2 5 11 120u
.ends
```

IV. Proposed CM Receiver Using MOSFET Based CFA

While designing the model for CFA, the proper aspect ratios for CMOS are used so as to follow the characteristic matrix of CFA in matrix equation. Using this modeled CFA, a circuit file is devised for a receiver section of Fig.5. Because of the space constraint, a code for the CFOA is given and is simulated using HSPICE software. The receiver is operated at a very low voltage of 1V. The total power consumed by CM receiver circuit is 2.2357 mW. Because of device level, it has become feasible to achieve low power consumption in CM receiver. The modulated signal from the transmitter is received by sallen key filter, which produce two different frequency. This frequency envelop are detected by rectifier. Filter converted into dc signal in which comparator produced demodulated signal. Sallen key band pass filter is used in receiver. The amplifier is used as MOSFET based CFOA.

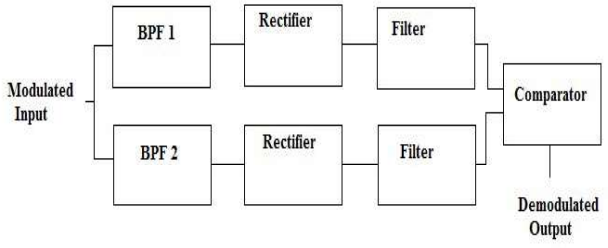

Fig.5.FSK Receiver

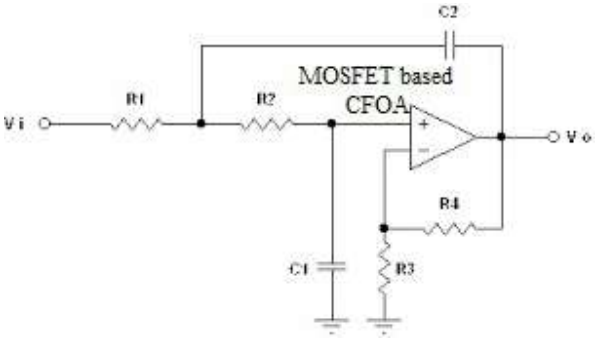

Fig.6.Sallen Key

Sallen key band pass filter is used in receiver. The amplifier is used as MOSFET based CFOA.

Code foe Sallen Key

```
bpfilter
*.ac dec 10 1 1e6
.tran 10000n 1m 0s
*.print vtggaina = PAR('v(6a)/v(ina)')
*.print vtggainb = PAR('v(6b)/v(inb)')
.include ad844s.cir
*****************************************
*V1 ina 0 ac 1.5
*V1 ina 0 ac sin(0 1 3k 0 0)
V1 ina 0 SIN (0 1V 3kHz 0 0 0)

Vdda 7a 0 dc 10
Vssa 0 4a dc 10

R1a 1a ina 26.5k
R2a 6a 2a 106k
R3a 1a 0 268
R4a  5a  0  100k
C1a 6a 1a .01u
C2a 2a 1a .01u

X1 0 2a 7a 4a 6a 5a AD844S
*****************************************

*V2 inb 0 ac 1.5
*V2 inb 0 ac sin(0 1 6k 0 0)
V2 inb 0 SIN (0 0V 6kHz 0 0 0)
R1b 1b inb 31.262k
R2b 6b 2b 53k
R3b 1b 0 133.96
R4b  5b  0  100k
C1b 6b 1b .01u
C2b 2b 1b .01u
X2 0 2b 7a 4a 6b 5b AD844S
*****************************************

*R5c 5c 0 100k
*X3 6a 6b 7a 4a 6c 5c AD844S
.probe V(6c)
*****************************************
.end
```

The demodulated output is obtain at the end of the receiver. Figure 7 shows that the desire dc output. The bandwidth increases and independent upon the gain in the current mode circuits as compare with the circuits in voltage mode as shows in figure 8.

Fig.7.Output Waveform of sallen key

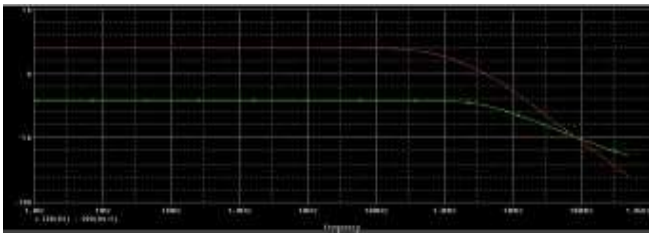

Fig.8.Difference between Cm-Vm

V. CONCLUSION

Current mode receiver is beneficial from high data rate transmission point of view. A current mode receiver which can operate at very high frequency in MHz is presented here. This has become feasible because of gain-bandwidth independency of current mode building blocks such as CFA (AD844). The proposed current mode receiver can work at very low voltages and consume less power, 123 mW compare to voltage mode receiver, 291 mW.

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