

Design of Low Transconductance OTA

Mulpuri Divya, Vignans Institute for Science Technology and Research

July 1, 2021

Abstract

A low transconductance high gain OTA has been implemented based on series parallel gate driven technique. Transconductance has very special significance in CMOS analog circuits.

Operational Transconductance Amplifiers OTAs are used in the design of analog pre-processing circuits used in the applications like sensors, portable devices, active analog filters and hearing aids. Operational Transconductance Amplifier OTA is widely used in the devices which operate at low frequency.

A low transconductance high gain Operational Transconductance Amplifier OTA can be implemented on eSim using the skywater 130nm PDK to analyse the results of the design.

1 Circuit Details

Operational Amplifiers Opamps were widely used in many analog circuit implementations. But due to power hungry and frequency limit characteristics Opamps has been replaced by Operational Transconductance Amplifier OTA. OTA is widely used for the conversion of voltage to current. In OTA differential input voltage produces current as output and it is a voltage controlled current sources VCCS.

Low transconductance transconductor and low power is required for biomedical applications. Transconductance has importance in CMOS analog circuits it indicates the ability of device to transfer input voltage to output current. The PMOS current mirrors are placed in series and parallel to achieve the Transconductance.

An ideal Operational Transconductance Amplifier OTA has two input voltages with infinite input impedance. The voltages V_{in-} as v_1 and V_{in+} as v_2 are the inverting and non-inverting input voltages applied to the circuit. The current I_{bias} is the bias current which mainly helps in controlling the gain of the amplifier. The bias current I_{bias} is proportional to the transconductance of Operational Transconductance Amplifier OTA.

The transconductance can be calculated by using series parallel as G_m is equal to g_{m1}/N_2 where transconductance of the transistor M7 is g_{m1} and Number of transistors in series and parallel is N . series parallel current division was applied in symmetrical OTA to achieve low transconductance with extended linear region.

2 Implemented Circuit

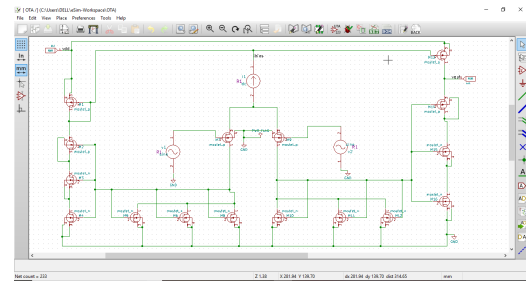


Figure 1: Implemented circuit diagram.

3 Implemented Waveforms

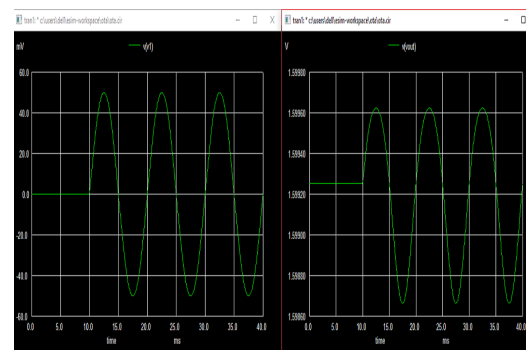


Figure 2: Implemented waveform.

References

- [1] P. S. Sushma. Design of low transconductance ota and its application in active filter design. ieeexplore.ieee.org/document/8862617.