

Folded Cascode Amplifier

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Abstract

Speed and accuracy are two of the most important properties of analog circuits however optimizing circuits for both aspects leads to contradictory demands. In high performance analog integrated circuits such as pipeline A/D converters Op Amps with very high DC gain and high unity gain frequency are needed to meet both accuracy and fast settling requirements of the systems. However as CMOS design scales into low power low voltage and short channel CMOS process regime satisfying both of these aspects leads to contradictory demands and becomes more and more difficult since the intrinsic gain of the devices is limited. This circuit can be implemented in esim EDA tool and will be done using Sky Waters 130nm PDK.

2 Implemented Circuit

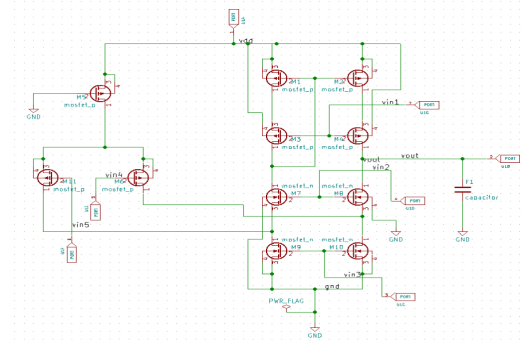


Figure 1: Implemented circuit diagram.

3 Implemented Waveforms

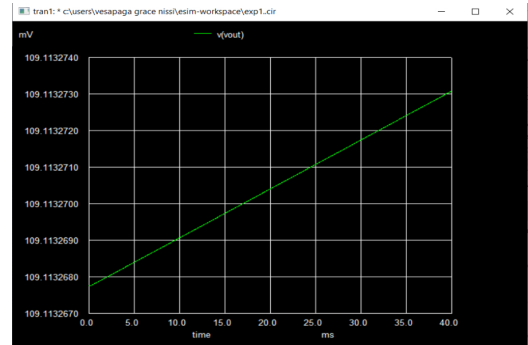


Figure 2: Implemented waveform.

1 Circuit Details

It is well known that the active cascade gain boosting technique can be used to increase the DC gain of an Op Amp without degrading its high frequency performance. Unfortunately the existence of pole zero doublet will unfavourably affect the settling performance of the gain boosted Op Amp and the effort of pushing up the doublet can raise stability problem. Also in correlated double sampling(CDS) and correlated level shifting(CLS) methods two clock cycles are needed to amplify so the speed may be reduced. The new structure proposed in this paper is based on the conventional folded cascode amplifier. Folded cascode amplifier is a single-pole operational amplifier with a large output swing and has a higher gain compared to the ordinary op amp. It is very suitable for deep negative feedback because of its small signal gain that can be very large. Comparing to the ordinary telescopic amplifiers folded cascode operational amplifiers have a larger output swing. To increase the DC gain of the Op Amp a new method is presented that uses positive feedback concept. Opposite to conventional techniques this technique does not add extra nodes to the structure of the Op Amp or pole zero doublet to the transfer function of the Op Amp. The folded cascode configuration achieves output impedance comparable to that of a normal telescopic amplifier with lesser number of devices stacked between supplies and ground in the output stage.

References

- [1] L. C. S. N. A. M. M. Isa and F. Musa. Design and analysis of folded cascode operational amplifier using 0.13 μm cmos technology. <https://aip.scitation.org/doi/pdf/10.1063/1.5142133>.