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Simulation study of L-V-F-C Operational Amplifier

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Abstract—In this research paper, Simulation study of folded cascode Op Amp based on low voltage has been performed. DC voltage gain, average power, unity gain bandwidth and output resistance have been computed using HSPICE Software. Low voltage folded cascode Op Amp results in high performance. Further, the low voltage Cascode Op Amp has better DC Gain, output resistance and less power dissipation. Thus the simulation studies have revealed that the performance of the low voltage folded cascode Op Amp can be improved optimized at different voltage.

Index terms- low voltage, folded cascode Op Amp, simulation, dc gain, power consumption, output resistance, Bandwidth

I. INTRODUCTION

Supply voltage reduction guarantee the reliability of devices as the lower electrical fields inside layers of a MOSFET produces less risk to the thinner oxides, which results from device scaling. However, the reduction in supply voltage leads to degraded circuit performance in terms of available bandwidth and voltage swing. Scaling down the threshold voltage of the MOSFETs reduces the performance (degraded bandwidth, low voltage swing etc.) to some extent but there is increase in the static power dissipation.. [1-10]. The performance analysis of conventional Op Amps techniques at large channel length is going to out of reach in near future. The appropriate topology is suggested which has a perfect balance between complexity and performance. Scaling of complementary metal-oxide semiconductor (CMOS) technology to the nano ranges has many limitations and leads to increase the leakage currents, power dissipation, and short-channel effects [16-20].

II. PROPOSED FOLDED CASCODE OP AMP DESIGN

The Figure 1 shows the schematic of a folded-folded cascode op-amp using a class AB output buffer. In the frequency response of the op-amp, the load of the op-amp is a 1 pF capacitor. Folded cascode Operational Amplifier is designed at different voltages. The widths of MOSFETs are chosen to be identical for a reasonable comparison.
We simulated the proposed circuit using HSPICE which can be used in VLSI systems such as microprocessors, DSP architectures and nano-micro systems.

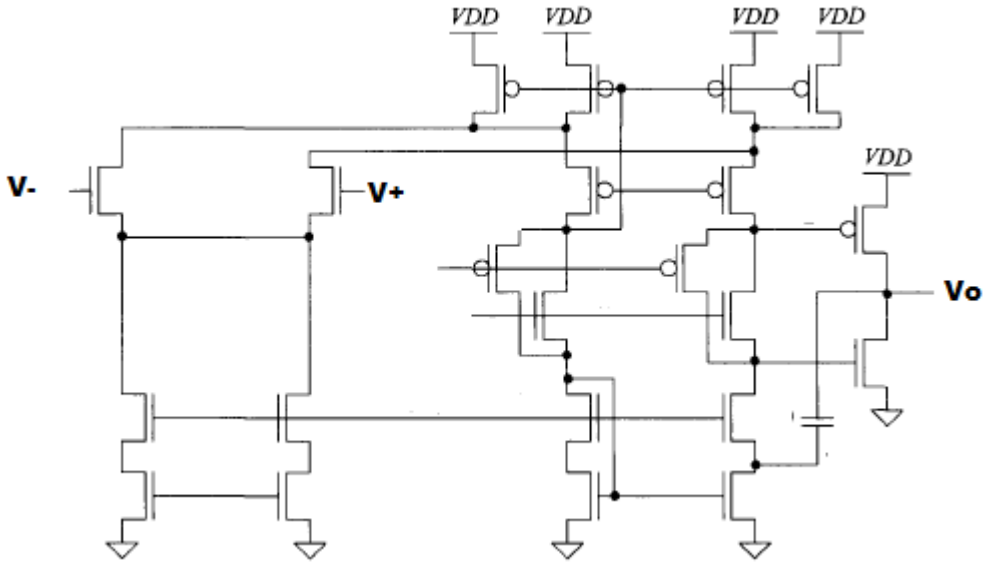

Figure 1. Proposed FOLDED CASCODE OP AMP DESIGN

SIMULATIONS OF PROPOSED FOLDED CASCODE OP AMP DESIGN

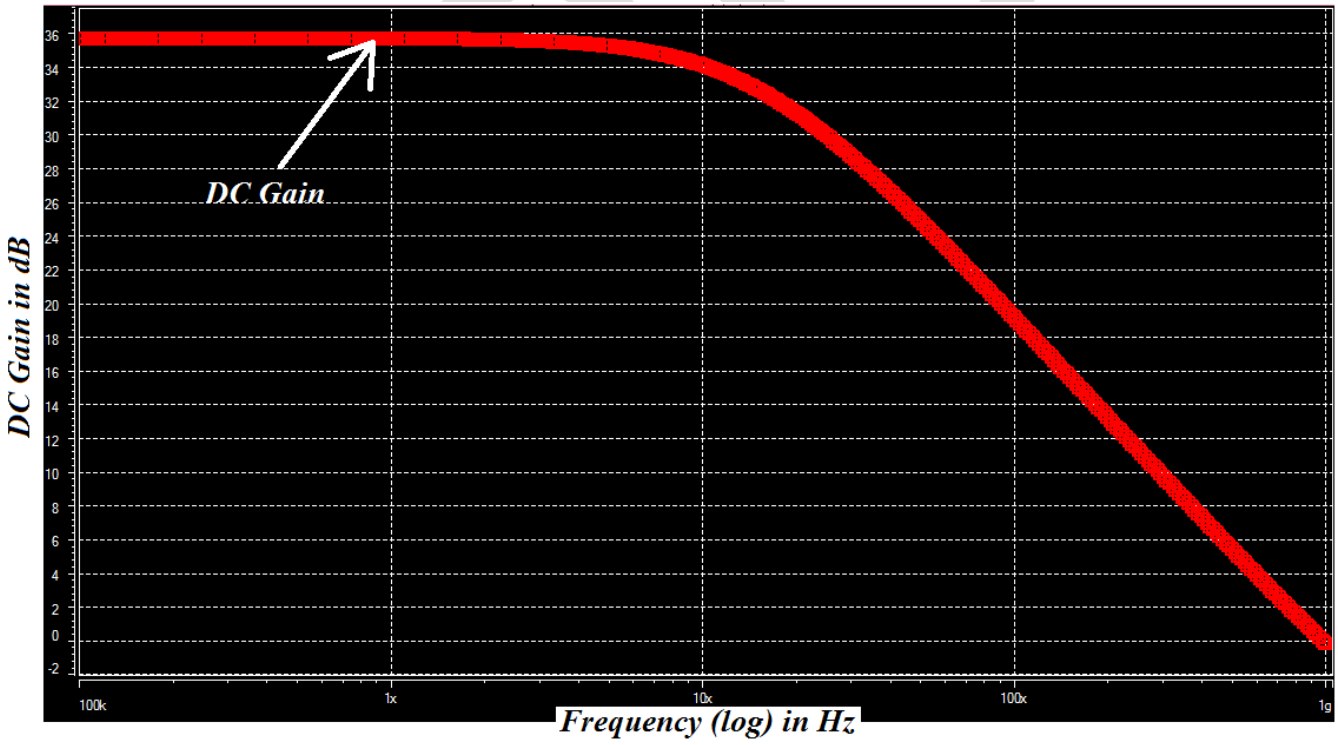

Figure2: Frequency response of CMOS based folded cascode op amp design at 1.4V

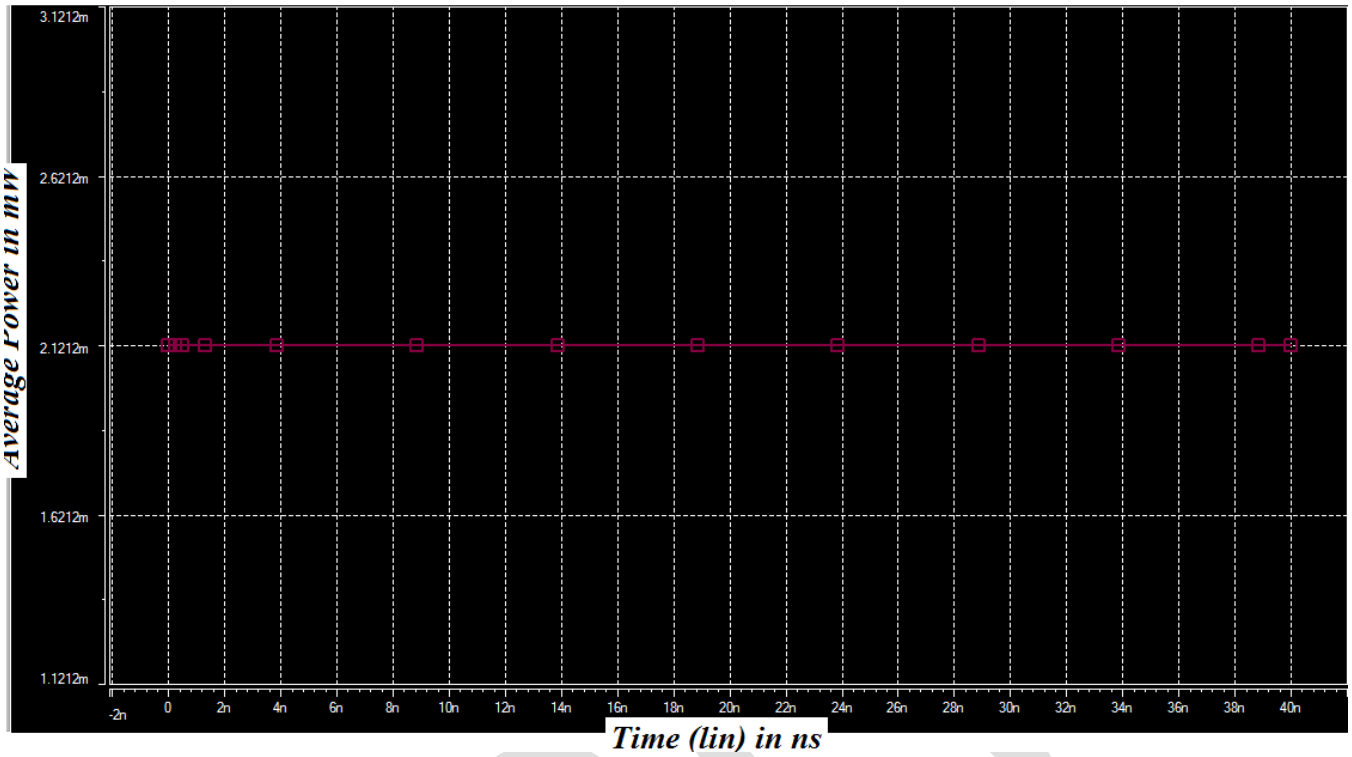

Figure 3: Average Power of CMOS based folded cascode op amp design at 1.4V

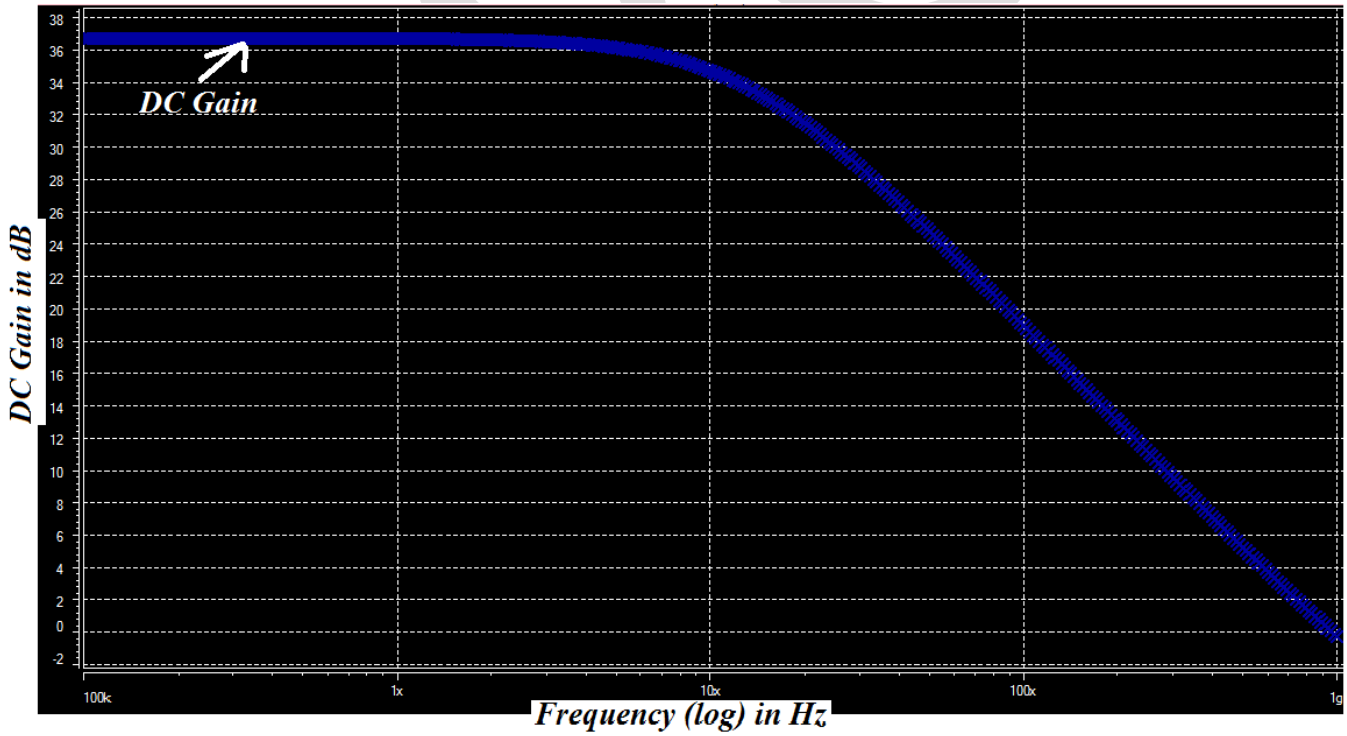

Figure4: Frequency response of CMOS based folded cascode op amp design at 1.2V

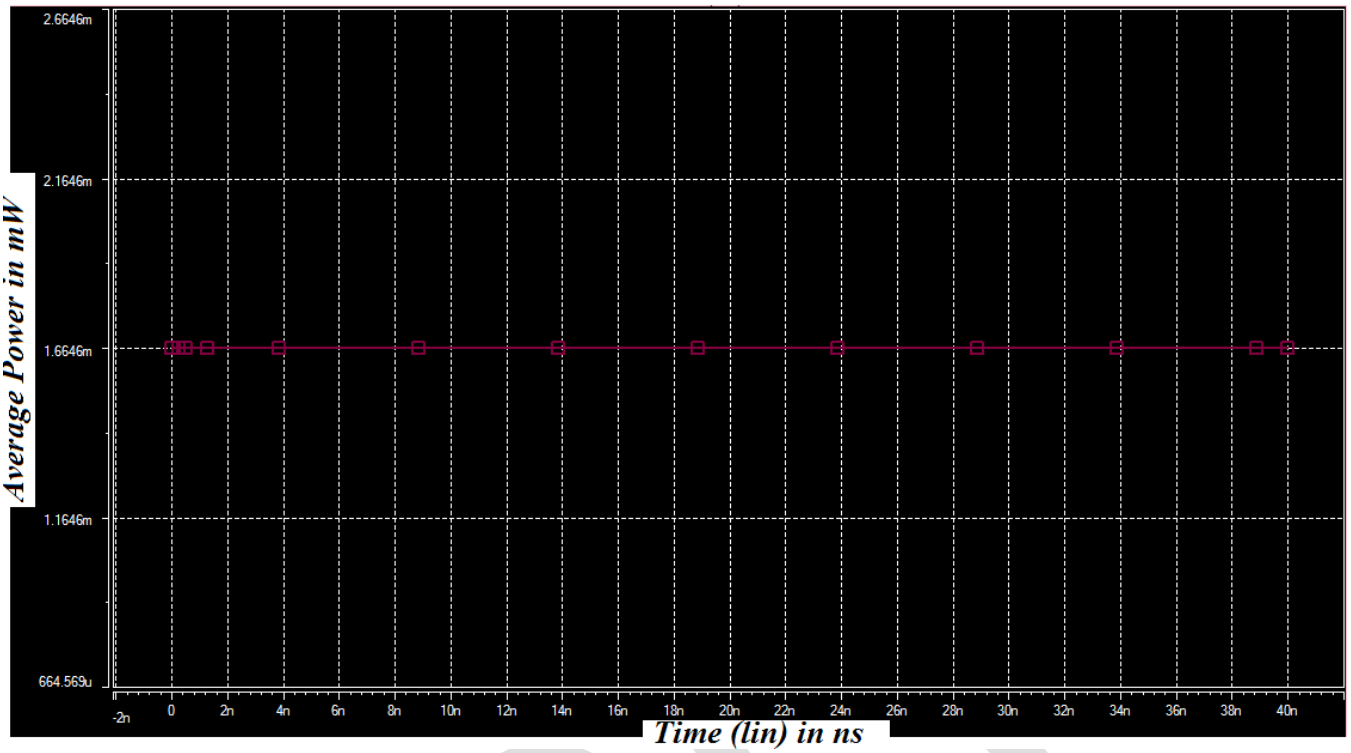

Figure 5: Average Power of CMOS based folded cascode op amp design at 1.2V

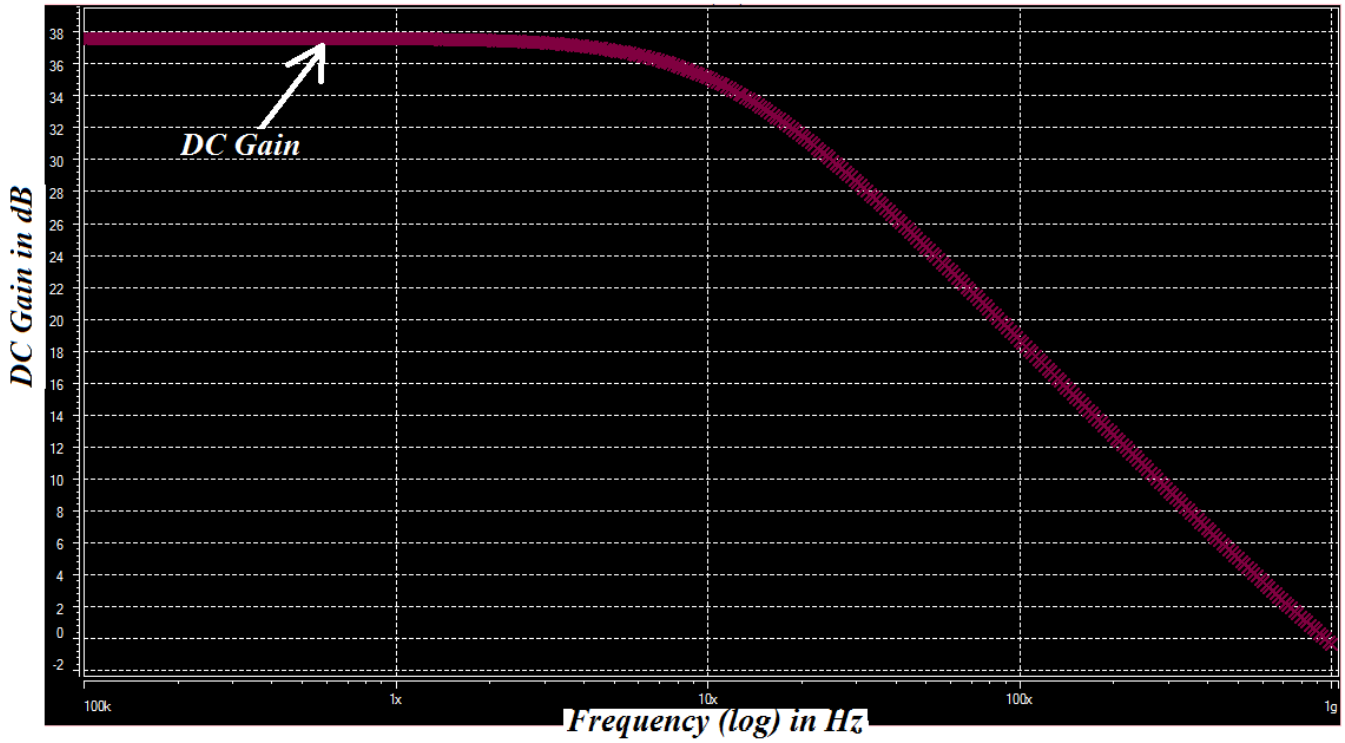

Figure6: Frequency response of CMOS based folded cascode op amp design at 1 V

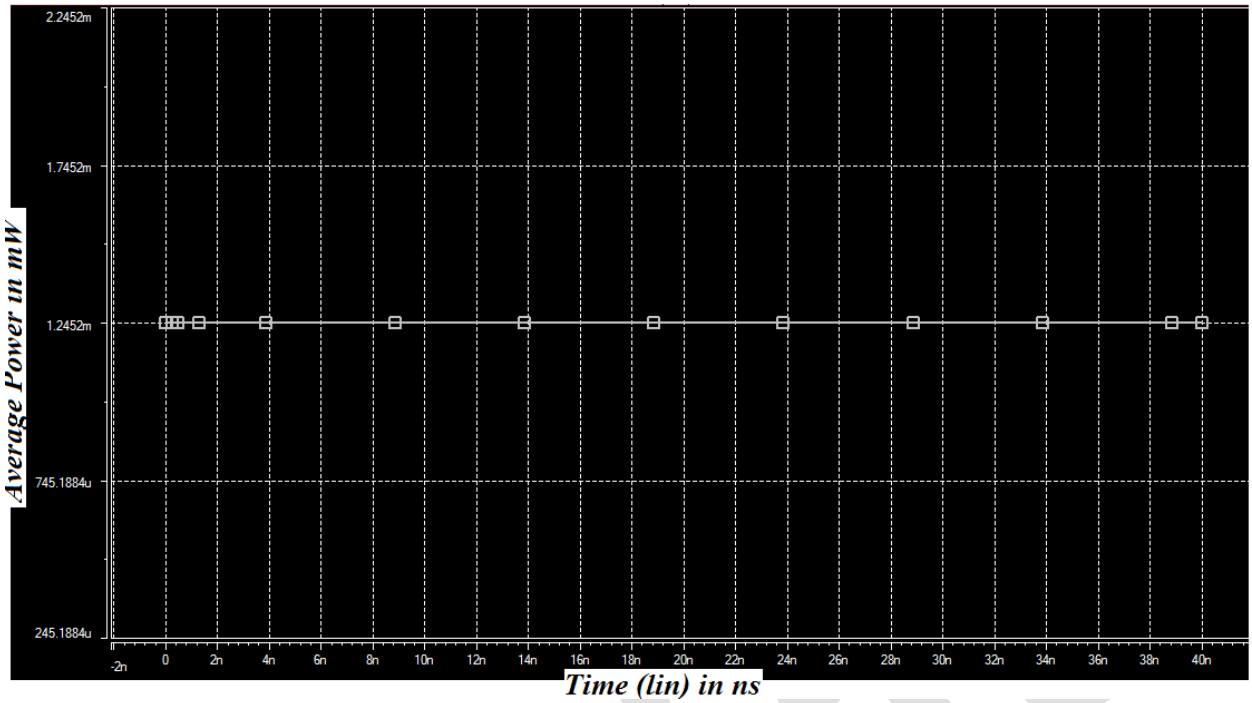

Figure 7 Average Power of CMOS based folded cascode op amp design at 1V

Table 1: Comparative analysis of Folded Cascode Op Amp Design with C_L = 1 pf , at different V_{DD} .

S. NO.	PARAMETERS	CMOS BASED FOLDED CASCODE AMPLIFIER AT 1V	CMOS BASED FOLDED CASCODE AMPLIFIER AT 1.2V	CMOS BASED FOLDED CASCODE AMPLIFIER AT 1.4 V
1	DC GAIN	37.6 dB	36.7 dB	35.7 dB
2	Unity Gain Freq	951 MHz	963 MHz	978 MHz
3	Output Resistance	23.1 Ohms	23.4 Ohms	24 Ohms
4	Average Power	1.24mW	1.66mW	2.12 mW
5	Phase Margin	79.2^0	80.5^0	81^0
	Slew Rate	8.57E+8	1.1E+9	1.3E+9

III. CONCLUSION

In this research paper, simulation of low voltage folded cascode Op Amp based on different voltages has done at 45 nm .DC voltage gain, average power, Unity gain bandwidth and output resistance have been computed using HSPICE Software . low voltage folded cascode Op Amp results in high performance. The proposed low voltage Cascode Op Amp is better for applications in VLSI design for low voltage applications.

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