THE DESIGN AND ANALYSIS OF CMOS TELESCOPIC DIFFERENTIAL AMPLIFIER

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LAILATUL NIZA BT. MUHAMMAD
Faculty of Electrical Engineering
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM, SELANGOR

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In the name of Allah S.W.T
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Praise be to Allah, Lord of the Universe,
And Peace and Prayers be upon
His Final Prophet and Messenger

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ABSTRACT

This thesis presents the design of a CMOS telescopic differential amplifier based on the given specification such as supply voltage equal to 3V, open loop voltage gain equal to 2000 (66dB), differential output swing equal to 3V and power dissipation equal to 18mW. The DC and AC analysis have been done to determine the overall circuit performance. Both the theoretical calculations and CAD tool simulation are used to compare the results and verify the design. The CAD tool is based on generic 0.5-μm technology. Finally, the schematic simulation and the performance of the CMOS telescopic differential op-amp are obtained.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Designing high-performance analog circuits is becoming increasingly challenging with the persistent trend toward reduced supply voltages. The main bottleneck in an analog circuit is the operational amplifier [10]. Operational amplifiers (op-amp) have made lasting inroads into virtually every area of analog and mixed analog-digital electronics system design [3]. Op-amp is an integral part of these systems and proper selection of its external components could be configured for a variety functions ranging from dc bias generation to high speed amplification or filtering [2]. At large supply voltages, there is a tradeoff among speed, power, and gain amongst other performance parameters. Often these parameters present contradictory choices for the op-amp architecture.

Recently, to reduced supply voltages and develop the high performance integrated electronic systems or subsystems, e.g. A/D converters, switched-capacitor (SC) filters, RF modulators and audio systems, CMOS operational amplifiers with high dc gain, high unity-gain bandwidth and large dynamic range are necessitated. Several topologies were considered to meet those requirements such as telescopic op-amp, folded-cascode, triple-cascode, two-stage op amp, and gain boosting applied to telescopic op amp. Table 1.1 shows the comparison of performance of several op amp topologies and Figure 1.1 shows the most popular topologies of operational amplifier.

Table 1.1: Comparison of performance of various op amp topologies [2].

	Gain	Output Swing	Speed	Power Dissipation	Noise
Telescopic	Medium	Medium	Highest	Low	Low
Folded-Cascode	Medium	Medium	High	Medium	Medium
Two-Stage	High	Highest	Low	Medium	Low
Gain-Boosted	High	Medium	Medium	High	Medium