

CERTIFICATE

This is to certify that the work contained in this dissertation entitled “ANALYSIS OF MCFOA BASED FUNCTION GENERATOR” by Ravinder Singh Rawat has been carried out under my supervision for the award of the degree of “**Master of Technology**” in **Control and Instrumentation** of Delhi Technological University, Delhi.

The matter submitted in this report has not been submitted to any other institute or university for award of any degree or diploma, to the best of my knowledge.

Mr Ram Bhagat

Assistant Professor

EED, DTU

DELHI-42

ACKNOWLEDGEMENT

I feel honoured in expressing our profound sense of gratitude to my mentor **Mr Ram Bhagat** (Assistant Professor), Electrical Engineering Department, Delhi Technological University (Formerly Delhi College of Engineering) for giving me the opportunity to work on such a practical problem, under his expert guidance. He constantly guided me throughout the project.

I also thank all the non-teaching staff of the Electrical Engineering department for their fullest cooperation.

I would like to thank all those who have directly and indirectly helped me in completion of thesis.

Ravinder Singh Rawat

Roll No. : 2K11/C&I/09

ABSTRACT

Instrumentation is very important part in signal processing, most system there is a voltage feedback oscillator which provides oscillation to the instrument but nowadays there is a concept of current feedback oscillator which provides high oscillation which is a demand of fast world. Here using current feedback operational amplifier we are building modified current feedback operational amplifier (MCFOA).

Use of high speed MCFOAs in analog signal processing offers several advantages over voltage feedback operational amplifier. These advantages are wide bandwidth, high slew rate, and ease of realizing various functions with the least possible number of external passive components. They do not require any component-matching requirements. There is also a growing demand/interest in realization of active filter, sinusoidal oscillators using MCFOA. The maximum frequency of operation of any circuit depends on the bandwidth of the amplifier. Signal generator build with a MCFOA will operate at higher frequencies than that of a VFOA. Today's electronic systems require many signal waveform shapes in addition to the sinusoidal waveform. Common waveforms are the square wave, triangular wave, and single pulse wave with fixed duration. Fixed duration pulses are used in communication and control systems. Square waves are used as a clock for digital systems. Triangular waves are used for scanning an electron beam on a CRT screen, in precise time measurements, and in time modulation.

LIST OF FIGURE

Figure number. /Description	Page number
1.1 CFA Model	2
1.2 Stability analysis circuit	3
1.3 Stability analysis of circuit	3
1.4 Non-Inverting CFA	5
1.5 Inverting CFA	7
1.6 AD 844 IC pin configuration	9
1.7 Equivalent schematic of CFOA	11
1.8 Simplified schematic of CFOA	12
1.9 Basic feedback circuit	14
1.10 The current form of the basic current feedback network	17
3.1 Symbol of CFOA	33
3.2 Representative schematic of a CFOA	35
4.1 Sinusoidal oscillator using CFOA	37
4.2 Sine wave of CFOA oscillator	40
4.3 CFOA integrator	41
4.4 Bode plot of CFOA integrator	41
4.5 A positive feedback loop capable of bistable operation	42
4.6 A bistable circuit	43
4.7 V_{in} - V_o characteristic for increasing V_{in} / decreasing V_{in}	44
4.8 Complete V_{in} - V_o characteristic	45
4.9 Non-inverting bistable circuit and characteristic	45
4.10 Triangular and rectangular wave generator	46
4.11 Up-warding ramping voltage for the integrator	47
4.12 Schmitt trigger using CFOA	48

4.13	Triangular waveform	48
4.14	Rectangular and triangular wave using CFOA	50
5.1	Symbol of CFOA	51
5.2	Symbolic representation of the MCFOA	52
5.3	MCFOA construction using commercially available active device	52
5.4	Developed CMOS structure for the MCFOA	53
6.1	Sine wave oscillator using MCFOA	56
6.2	Building of the sine wave oscillation in MCFOA circuit	59
6.3	Sine wave oscillation by MCFOA	60
6.4	MCFOA integrator	60
6.5	Bode plot of MCFOA integrator	61
6.6	Triangular and rectangular wave generator using MCFOA	62
6.7	A general scheme for generating triangular and square waveform	62
6.8	Generation of rectangular wave using MCFOA	64
6.9	Generation of triangular wave using MCFOA	65

TABLE OF CONTENTS

CONTENTS	PAGE NO
Certificate	I
Acknowledgement	II
Abstract	III
List Of Figures	IV
Contents	VI
1 INTRODUCTION	
1.1 Introduction Of CFA	1
1.2 CFA Model	2
1.3 Development Of The Stability Equation	3
1.4 The Non-Inverting CFA	4
1.5 The Inverting CFA	6
1.6 CFOA AD844 IC Introduction	8
1.7 Product Highlights	9
1.8 Understanding The Ad844	10
1.8.1 Open-Loop Behaviour	10
1.8.2 Circuit Description Of The AD844	11
1.9 Theory Of Oscillator	13
1.9.1 Introduction	13
1.9.2 Oscillation Conditions	14
1.10 Summary	19
2 LITERATURE REVIEW	
2.1 Literature Review On CFOA Oscillator	20
2.2 Literature Review On MCFOA Oscillator	29
2.3 Summary	30
3 CURRENT FEEDBACK OPERATIONAL AMPLIFIER	
3.1 CFOA Theory	31
3.2 Application For Current Feedback Op- Amplifier	32
3.3 Advantages And Disadvantages Of The CFOA	32
3.4 Basics Of CFOA	33
3.5 Operation Of CFOA	34
3.6 Summary	36

4 CFOA BASED OSCILLATOR	
4.1 Sinusoidal Oscillator Using CFOA	37
4.2 Simulation Result Of Oscillation	39
4.3 Integrator Using CFOA	40
4.4 Triangular And Rectangular Wave Generator Using CFOA	42
4.4.1 Multivibrators	42
4.4.2 Bistable Multivibrators	42
4.4.3 Transfer Characteristics Of A Bistable Circuit	43
4.4.4 Triangular And Rectangular Wave Generator Using CFOA	46
4.4.5 Simulation Results	49
4.5 Summary	50
5 MODIFIED CURRENT FEEDBACK OPERATIONAL AMPLIFIER	
5.1 Introduction	51
5.2 CMOS Realization Of Modified CFOA	51
5.3 CMOS Implementation Of Modified CFOA	52
5.4 Summary	54
6 MCFOA BASED OSCILLATOR	
6.1 Sine Wave Oscillator Using MCFOA	56
6.2 Calculation For Condition Of Oscillation And Frequency	57
6.3 Simulation Result Of Oscillation	59
6.4 Integrator Circuit With MCFOA	60
6.5 Triangular And Rectangular Wave Generator Using MCFOA	61
6.6 Simulation And Result Of Rectangular And Triangular Wave.	64
6.7 Summary	65
7 CONCLUSION AND FURTHER SCOPE	
7.1 Conclusion	66
7.2 Future Scope Of Work	66
REFERENCES	67