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Title of Thesis: **"Realization of Some Analog Signal Processing/ Signal Generation Circuits**"

Abstract

This thesis deals with the realisation of some analog signal processing circuits (voltage-mode and current-mode biquads) and some analog signal generating circuits (Sinusoidal oscillators) using Operational Amplifiers (op-amps), Current Conveyors (CCs), the Current Feedback Operational Amplifiers (CFOAs) and Current Differencing Transconductance Amplifiers (CDTAs), all of which are closely related and prominent building blocks in the area of modern analog circuit synthesis and design.

The main thrust of the work reported in this thesis has been on the generation / realization of new circuit configurations for current-mode/ voltage-mode biquad filters, current-mode oscillators and synthetic inductors using op-amps, CFOAs, and CDTAs with particular emphasis on attaining features or evolving the types of structures which have not been dealt with in the technical literature earlier. However, since the functioning of any circuit invariably contains interplay of voltages and currents, wherever relevant, the resulting or related voltage-mode circuits have also been detailed out.

First in the thesis we present an overview of the area of the recent developments in the area of analog circuits and review some sample hardware implementations of some selected active building blocks such as op-amp, CCI, CCII, CCIII, DDCC, FDCCII, DDA, FTFN, OTRA, CDBA, and CDTA. We also provide how some of these ABBs are implemented using commercially available CFOAs.

After this, we realise grounded capacitor single resistance controlled oscillators (SRCOs) through a simple general scheme using operational amplifier (op-amp), current conveyor, CFOA, FTFN with major emphasis on SRCO using NICs. SPICE simulation and hardware implementation have been appended for some representative circuits.

Next contribution of the thesis is on the realisation of current-mode biquads using CFOAs. The work done includes (i) brief review of work done in the literature, (ii) systematic generation of universal CM biquads using generalized structures and finally, (iii) a number current-mode universal biquads using one/ two CFOAs with a minimum number of passive elements. The workability of the derived structures has been verified by SPICE simulation.

After this, the thesis deals with the realisation of VM, CM biquads and finally single element/ parameter controlled oscillators using CDTAs. After reviewing the existing literature on VM/ CM biquads using single CDTA, two new VM biquads and a number of CM biquads are presented using single CDTA. The first single resistance controlled oscillator (SRCO) using CDTA was introduced where for the first time, the workability of the CDTA-based circuit had been verified experimentally using AD844 and CA3080 and finally a number of single element/ parameter controlled oscillators are presented using two CDTAs. The workability of the derived structures has been verified by SPICE simulation.

After this, this thesis deals with the use of CDTA in the realization of grounded inductor. First time a new CDTA- based grounded inductor and an alternative floating inductor have been introduced. In this we also introduced parallel R-L simulator, parallel resistance (R) and a negative inductance (-L) simulator and parallel resistance (R) with series R-L) simulator configurations. Thus, this chapter has added some new circuits to the existing repertoire of CDTA-based application circuits. SPICE simulations have established the workability of the proposed formulations.

A number of suggestions for further work have been made and it is hoped that the work presented in the thesis can be meaningfully extended further in several directions.