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Title of the Thesis: Design and Development of Analog Signal Processing /Generation Circuits.

ABSTRACT

The research work of this thesis presents the theoretical, mathematical analysis and the simulation results (based on the well known power full software of world fame known as PSpice) of "Design and Development of Analog Signal Processing /Generation Circuits". The main purpose of this research is to design and develop new analog signal processing/generation circuits in both mode current mode (CM) as well as voltage mode (VM).The entire research work of the thesis is confined to the filter circuits, oscillator circuits, inductor simulator circuits and admittance converter in the current mode and voltage mode employing three prominent modern analog active building blocks (ABB) namely voltage differencing voltage transconductance amplifier (VDVTA), voltage differencing Current Conveyers (VDCC) and voltage differencing transconductance amplifier (VDTA), which are closely related analog ABBs of recent origin, with a focus on achieving advantageous features which are not available simultaneously in earlier known circuit configurations.

The thesis begins by presenting a brief introduction and an overview of the recent developments in the area of analog signal processing / generation circuits and review of some selected analog ABBs has been reported in this thesis.

In chapter -2 , A new electronically controllable lossless/lossy floating inductor (FI) circuit without any component matching condition have been proposed which uses one VDCC, one grounded resistor and one grounded capacitor. The workability of FI circuits has been demonstrated by realizing a band pass filter and fourth order Butterworth low pass filter. The same chapter also realizes floating inductance simulation circuit using only two VDVTAs and one grounded capacitor. To confirm the viability of the designed simulated inductor, a 2^{nd} order voltage mode band pass filter has been performed. The first proposed circuit offers the following advantageous features: (i) only two passive component i.e. one grounded capacitor (as desired for IC implementation) and one grounded resistor, (ii) no matching condition, (iii) fully electronically controllable (by changing bias currents and (iv) reported very low active and passive component sensitivities, where as the second proposed circuit offers (i) grounded capacitor (ii) fully electronically controllable (iii) low active and passive sensitivities. The simulation result using 0.18µm TSMC, CMOS technology have been used to established the viability of the new designed floating inductance simulation circuits**.**

In chapter -3, two new applications of voltage differencing voltage transconductance amplifier has been proposed in this section one is current mode SIMO–type universal biquad and second is electronically controllable sinusoidal oscillator using single active building block VDVTA. The proposed filter realizes second order low pass, band pass, and high pass filters simultaneously. The other proposed oscillator circuits offers (1) independent control of FO and CO, (2) use of grounded capacitors which is desirable from the viewpoint of IC implementation, (3) availability of explicit CM output and (4) low active and passive sensitivities. Both the circuit offers low

active and passive sensitivities of ω_0. In the same chapter-3 we have also proposed new 3rd order quadrature oscillator using VDCCs. The proposed circuit uses 9 passive components (5 grounded resistors, 1 floating resistor and 3 grounded capacitors) and offers explicit current mode quadrature outputs at high impedance terminals and voltage mode quadrature outputs. The condition of oscillation (CO) of proposed circuit can be non-interactively tunable. The simulation result using 0.18µm TSMC, CMOS technology have been used to established the viability of the above presented work.

In chapter -4, a new purely active grounded to floating admittance convertor employing two VDTAs has been proposed. The presented circuits can convert any arbitrary grounded admittance into floating admittance The proposed structure have a beauty of electronically controllable multiplication factor, no need of any active/passive component matching condition and also bear a good non-ideal behavior. The effects of parasitic
of VDTAs also have been theoretically investigated in proposed structure. The utilization of proposed configuration in realization of floating resistor and floating capacitor has been presented and workability of these floating elements has been confirmed by active filter design examples. The mathematical analysis has been verified by SPICE simulations with TSMC 180nm CMOS technology.

Finally, conclusions of this thesis are made in Chapter 5, which also suggests some ideas for future research work.