Design, Analysis and Implementation of PID Controller Using VDTA

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CERTIFICATE

This is to certify that the ***Mr. Ajishek Raj, Roll no. 2k14/c&i/03****, student of* ***M.Tech, Control & Instrumentation, Department of Electrical Engineering, Delhi Technological University,*** *has submitted the dissertation entitled "****Design, Analysis and Implementation of PID Controller using VDTA****" under my supervision in partial fulfilment of the requirement for the award of the degree of Master of Technology in Electrical Engineering (Control & Instrumentation). This dissertation is a record of his work carried out by him under my guidance and supervision and has not been presented earlier for the award of any degree/diploma.*

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LIST OF SYMBOLS

S. No.	Symbols	Descriptions
1	t_r	Rise Time
2	t_s	Settling Time
3	e_{ss}	Steady State Error
4	A_o	Open Loop Gain
5	α	Current Gain
6	β	Voltage Gain in Active Blocks
7	ζ	Damping Factor
8	μ_n	Mobility of NMOS
9	w_o	Cut Off Frequency
10	T	Time Constant
11	K_P	Proportional Coefficient
12	K_I	Integral Coefficient
13	K_D	Derivative Coefficient
14	g_m	Trans-conductance
15	Z_i	Input Impedance
16	Z_o	Output Impedance
17	V_{ss}	Source Supply Voltage
18	V_{DD}	Drain Supply Voltage
19	I_o	Bias Current
20	I_b	Bias Current
21	OTA	Operational Trans-conductance Amplifier
22	CC	Current Conveyor
23	CFA	Current Feedback Amplifier

24	CFOA	Current Feedback Operational Amplifier
25	CDBA	Current Differencing Buffered Amplifier
26	CMOS	Complementary Metal Oxide Semiconductor
27	OA	Operational Amplifier
28	SFG	Signal Flow Graph
29	VLSI	Very Large Scale Integration
30	VCVS	Voltage Controlled Voltage Source
31	VCCS	Voltage Controlled Current Source
32	CCVS	Current Controlled Voltage Source
33	P	Proportional
34	I	Integral
35	D	Derivative
36	W/L	Transistor Aspect Ratio
37	C_{OX}	Gate Oxide Capacitance Per Unit Area
38	BJT	Bipolar Junction Transistor
39	CCCII	Second Generation Current Controlled Current Conveyor
40	$H_i(s)$	Transfer Function For Current Mode
41	$H_v(s)$	Transfer Function For Voltage Mode

ABSTRACT

Proportional - Integral - Derivative (PID) controllers are the mainstay of most of the control system employed in different process industries. Traditional PID controllers have been implemented using the voltage mode operational amplifiers. Performance of these VOA based PID controller is limited by the performance of the traditional VOA.

In this dissertation, current mode and voltage mode analog PID controller have been studied & implemented. The current mode and voltage mode building blocks chosen for study and implementation of the PID controllers are (i) Operational Trans-conductance Amplifier (OTA), (ii) Current Feedback Operational Amplifier (CFOA) and (iii) Current Differencing Buffered Amplifier (CDBA). The PID controllers have been implemented in PSPICE and closed loop performance of some prototype second order system has been studied to establish the workability of these PID controllers.

In this dissertation a novel fully differential current mode PID controller using VDTA has also been designed and implemented, and its performance has been evaluated by implementing it with second order system.

Keywords : OTA, CFOA, CDBA, VDTA

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