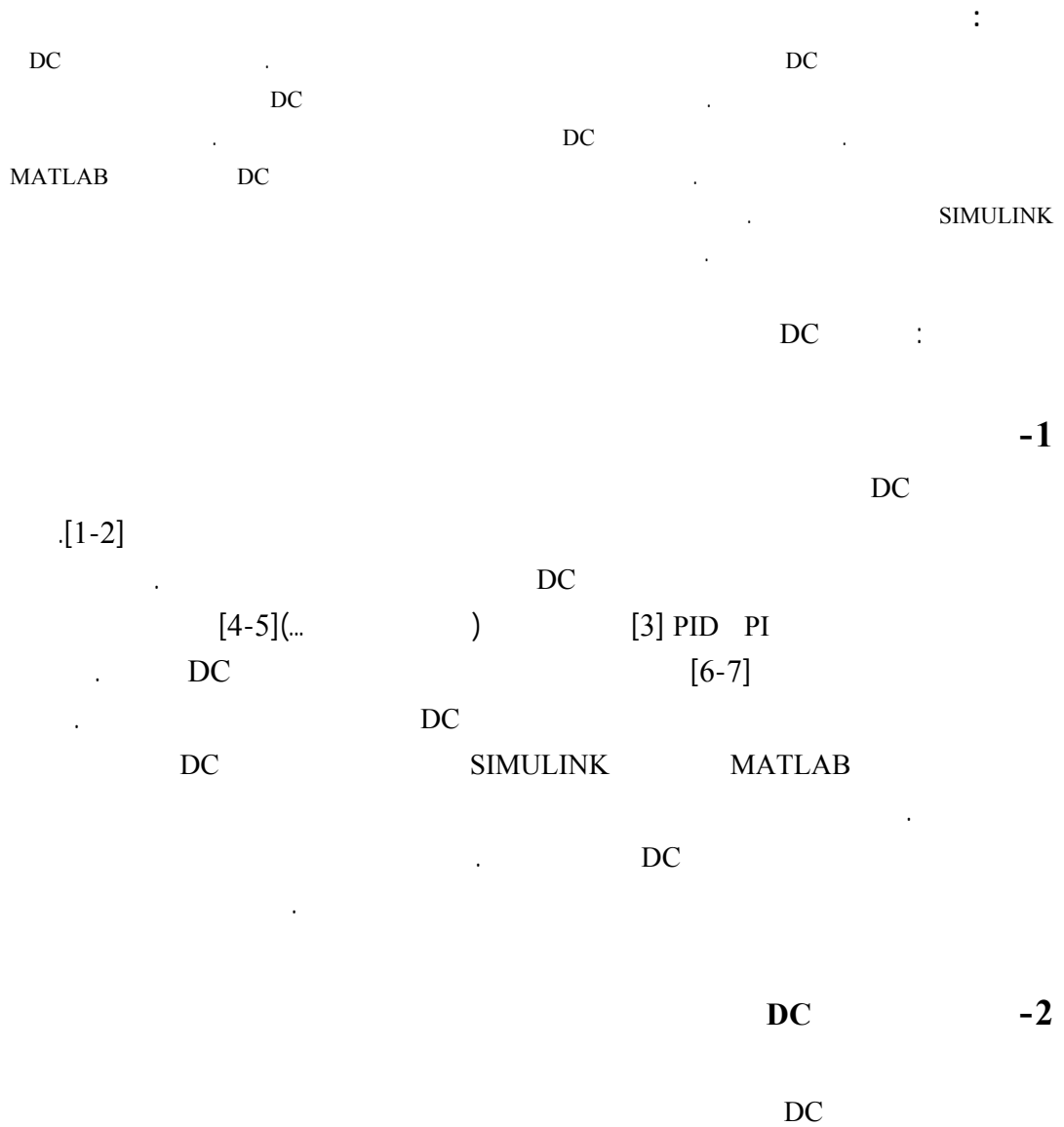
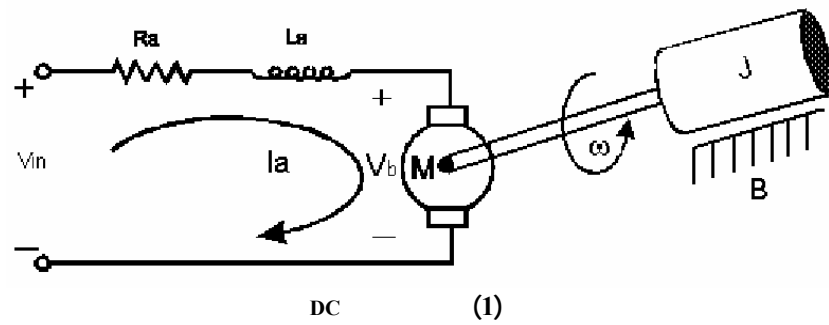


# DC

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$$V_t = L_a \frac{di_a}{dt} + R_a i_a + E_a \quad (1)$$

$$E_a = K \omega_m \quad (2)$$

$$J \frac{d^2 \theta}{dt^2} + B \frac{d\theta}{dt} - T_l = K i_a \quad (3)$$

$E_a$

$V_t \quad i_a \quad L_a \quad R_a$

$B \quad J$

$T_l$

$\omega$

$T_l \quad V_t$

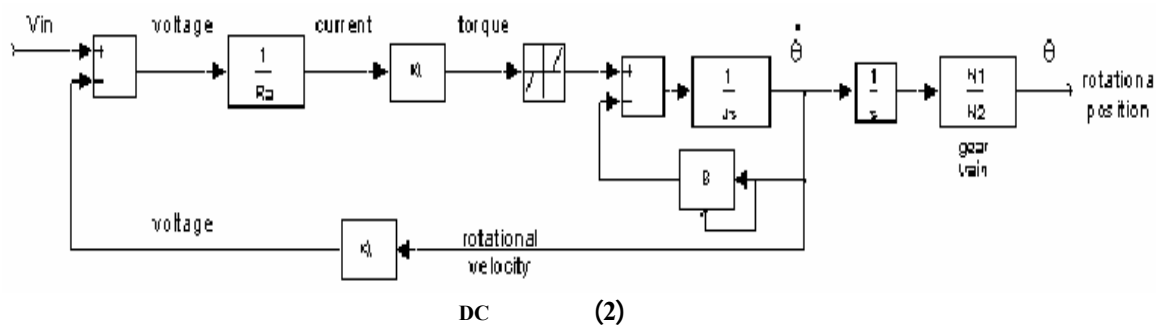
$\omega \quad i_a$

:

$$\frac{d}{dt} \begin{bmatrix} i_a \\ \omega \end{bmatrix} = \begin{bmatrix} \frac{-R_a}{L_a} & \frac{-K}{L_a} \\ \frac{+K}{J} & \frac{-B}{J} \end{bmatrix} \begin{bmatrix} i_a \\ \omega \end{bmatrix} + \begin{bmatrix} \frac{1}{L} & 0 \\ 0 & \frac{1}{J} \end{bmatrix} \begin{bmatrix} V_t \\ T_l \end{bmatrix} \quad (4)$$

(2)

DC



DC

(2)

:

DC

Torque Constant( $K_T$ ):45.9e-3Nm/A

Back EMF constant( $K_E$ ):45.9e-3V/rad/s

Resistance( $R_T$ ):4.62Ω

Inductance(L):3.97mH

No-load Current( $I_{NL}$ ):0.13A

Peak Current( $I_p$ ):6.55A

, Rotor inertia(J):5.98e-4 oz-in/sec<sup>2</sup>

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$\mu$

$$\begin{aligned} e(t) &= y(t) & (5) \\ \Delta e(t) &= y(t) - y(t-1) & (6) \end{aligned}$$

-4

PI D  
(2)

$$\frac{U(s)}{E(s)} = K_p + \frac{K_i}{s} + K_D s \quad (7)$$

$K_D$        $K_i$        $K_p$

$e(t)$

matlab

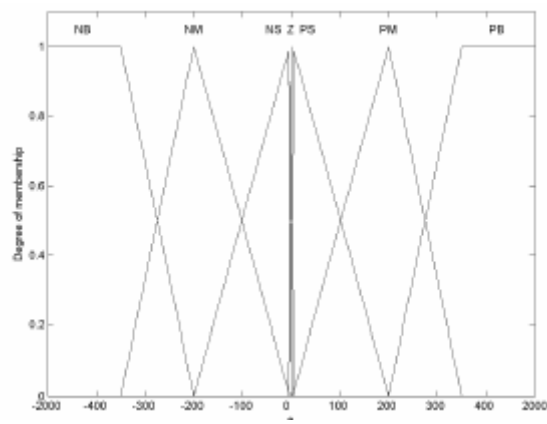
simulink

$\Delta e(t)$

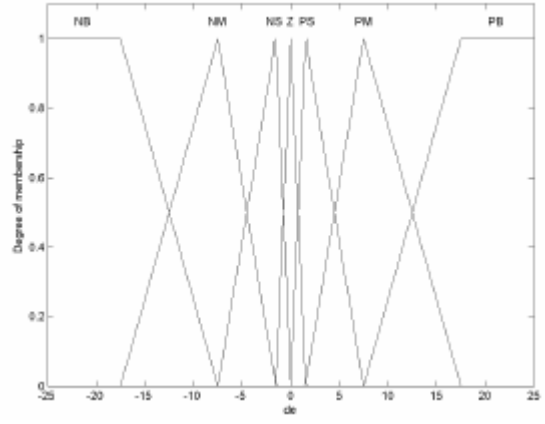
Negative Big = NB  
Negative Medium = NM  
Negative Small = NS  
Positive Small = PS  
Positive Big = PB  
Positive Medium = PM,      Zero = Z

(1)

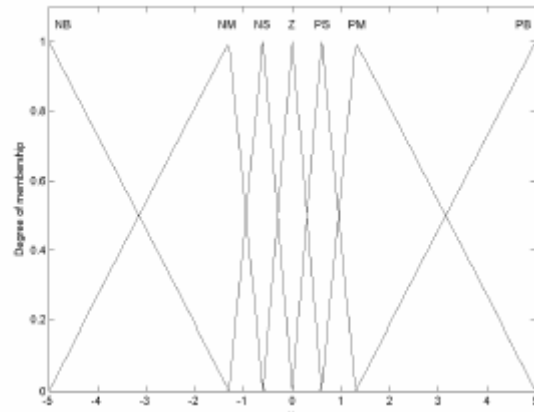
$\dot{e}/e$	NB	NM	NS	Z	PS	PM	PB
NB	NB	NB	NB	NB	NS	PS	PB
NM	NB	NB	NM	NM	Z	PS	PB
NS	NB	NB	NS	NS	Z	PM	PB
Z	NB	NB	NS	Z	PS	PB	PB
PS	NB	NM	Z	PS	PS	PB	PB
PM	NB	NS	Z	PM	PM	PB	PB
PB	NB	NS	PS	PB	PB	PB	PB



(3)

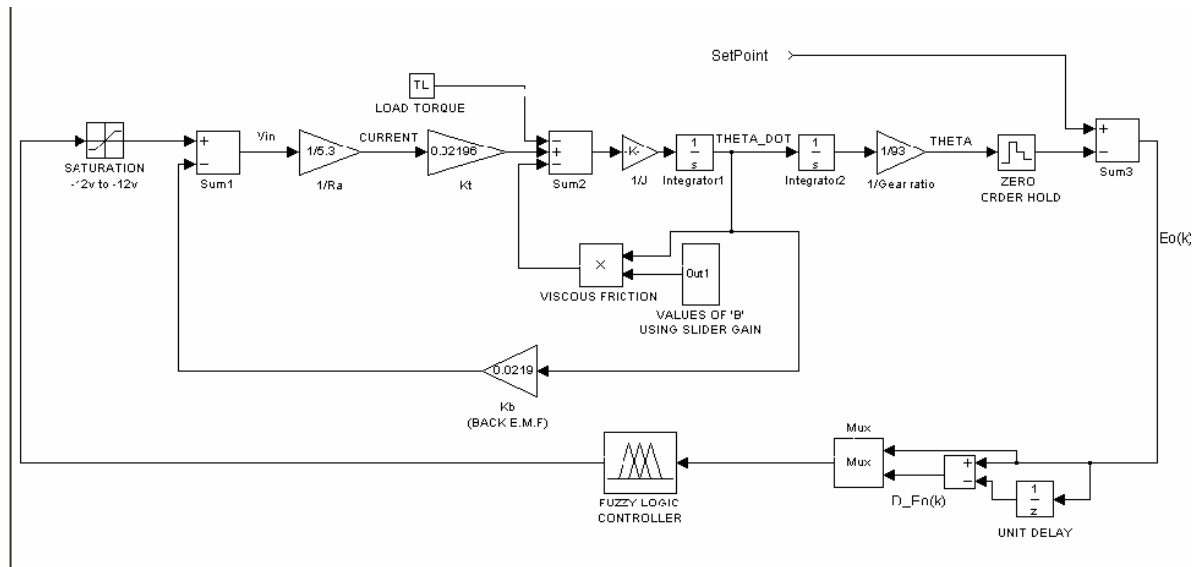


(4)



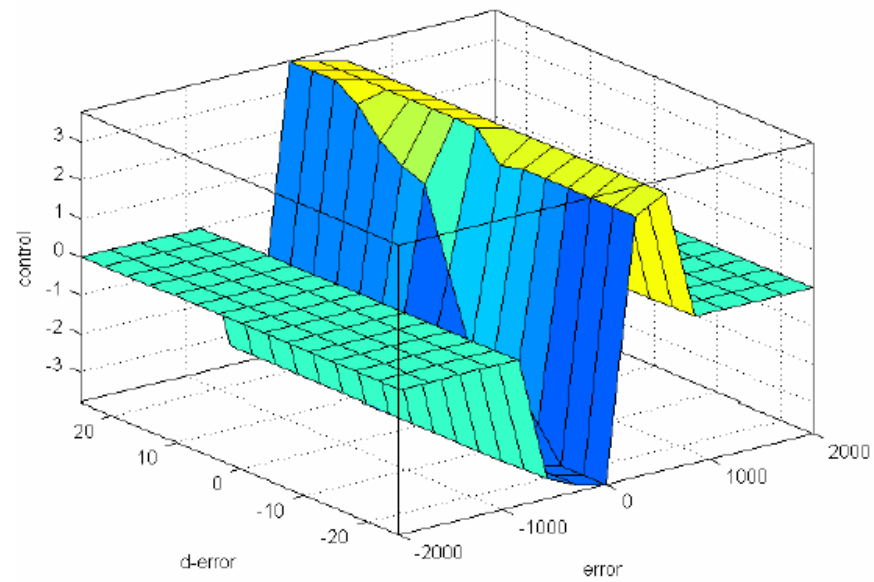
(5)

(6)



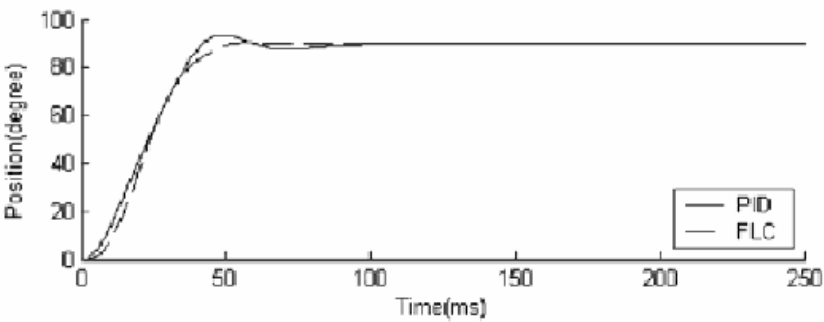
DC

(6)



(6)

(Fuzzy Logic Controller) FLC PID  
(7) 90° 0°



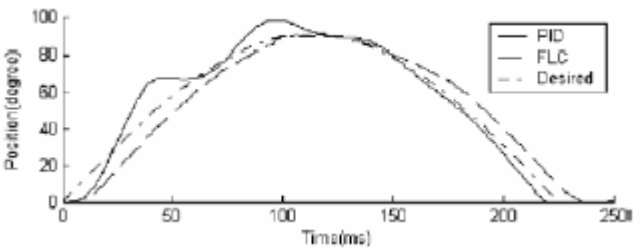
(7)

%4 PID PID 120ms

80ms %0.4 FLC  
250ms 38ms ( ) ITAE ( ) IAE  
PID FLC (2)

PID (8)

PID



(8)

90° 90° FLC  
FLC PID ITAE IAE.

ITAE IAE(2)

	Cont.	IAE	ITAE	$t_r$ (ms)	%OS	$t_s$ (ms)
Step rsp.	PID	57.78 (38ms- 250ms)	1851.8 (38ms- 250ms)	38	4	120
	FLC	34.2 (38ms- 250ms)	772.2 (38ms- 250ms)	39	0.4	80
Sinus rsp.	PID	554.83	25929			
	FLC	719.7	39919			

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DC

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[1]

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*simulink matlab*

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DC

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[7]Akin Delibasi,Turker Turker,Galip Cansever,Real-Time DC motor position control by fuzzy logic and PID controllers using labview,Yaldiz Technical University