CS EXPERIMENT-6

AIM

To study the closed loop characteristics of DC motor Proportional, derivative and integral control(Discrete-Time) and experiment it with a Matlab simulation file.

APPARATUS REQUIRED

A Laptop, MATLAB Simulink software by MathWorks INC.

THEORY

The analysis for designing a digital implementation of a PID controller in a Microcontroller (MCU) or FPGA device requires the standard form of the PID controller to be discretized. Approximations for first-order derivatives are made by backward finite differences.

The integral term is discretized, with a sampling time Δt,as follows,

$$\int_0^{t_k} e(\tau)d\tau = \sum_{i=1}^{k} e(t_i)\,\Delta t$$

The derivative term is approximated as:

$$\frac{de(t_k)}{dt} = \frac{e(t_k) - e(t_{k-1})}{\Delta t}$$

which gives us:

$$u(t) = K_p[\, e(t) + \frac{1}{T_i}\sum_{i=1}^{k} e(t_i)\,\Delta t + T_d \frac{e(t_k) - e(t_{k-1})}{\Delta t}\,]$$

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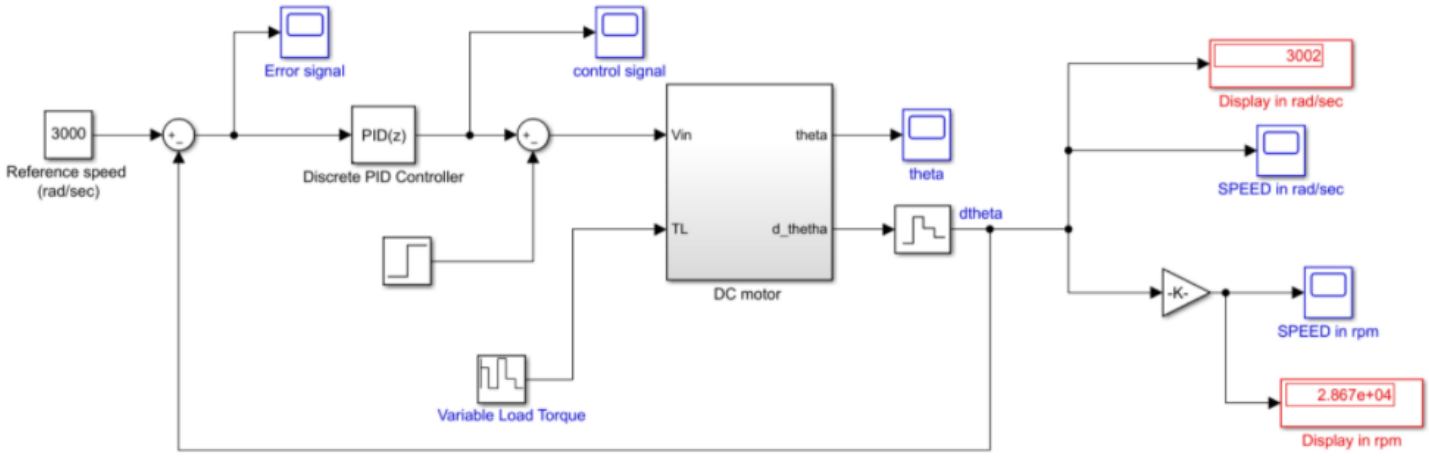
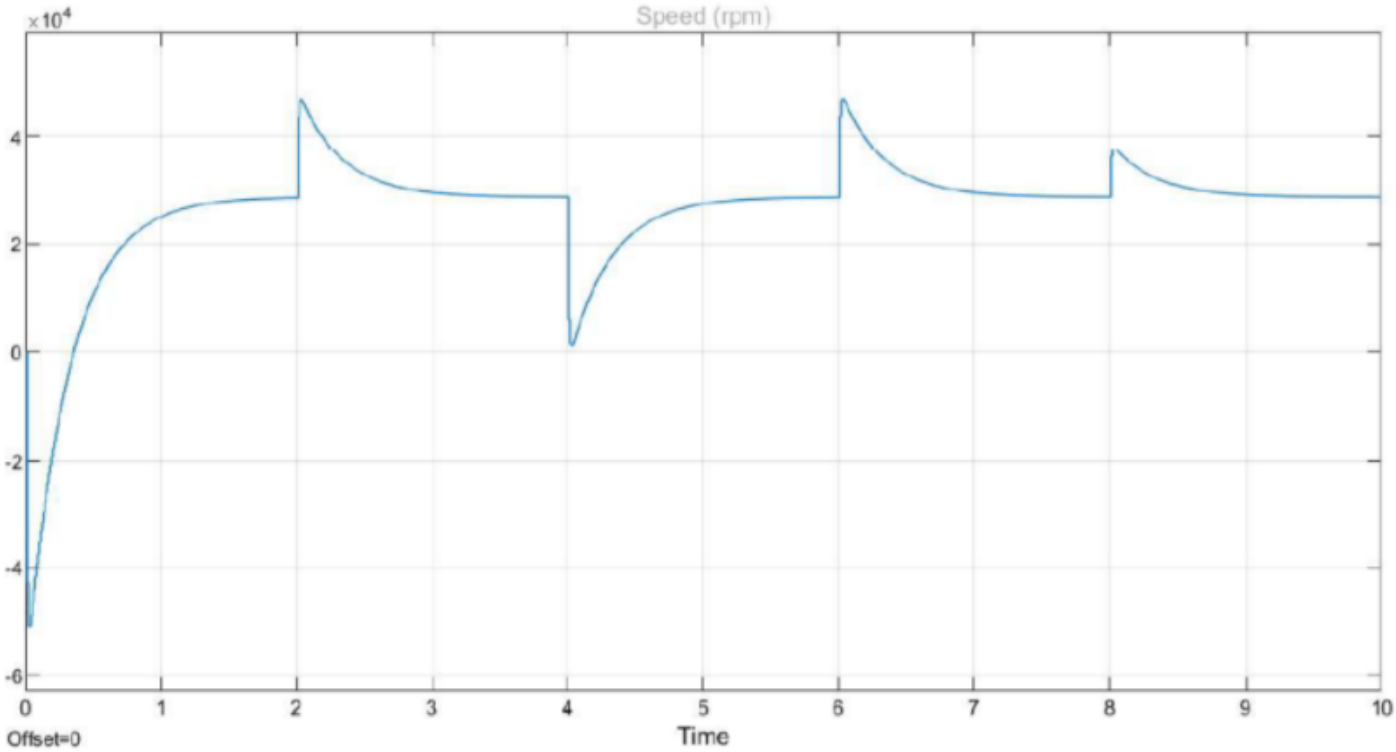
OBSERVATIONS & RESULTS

Simulink Model



Speed (RPM) vs time



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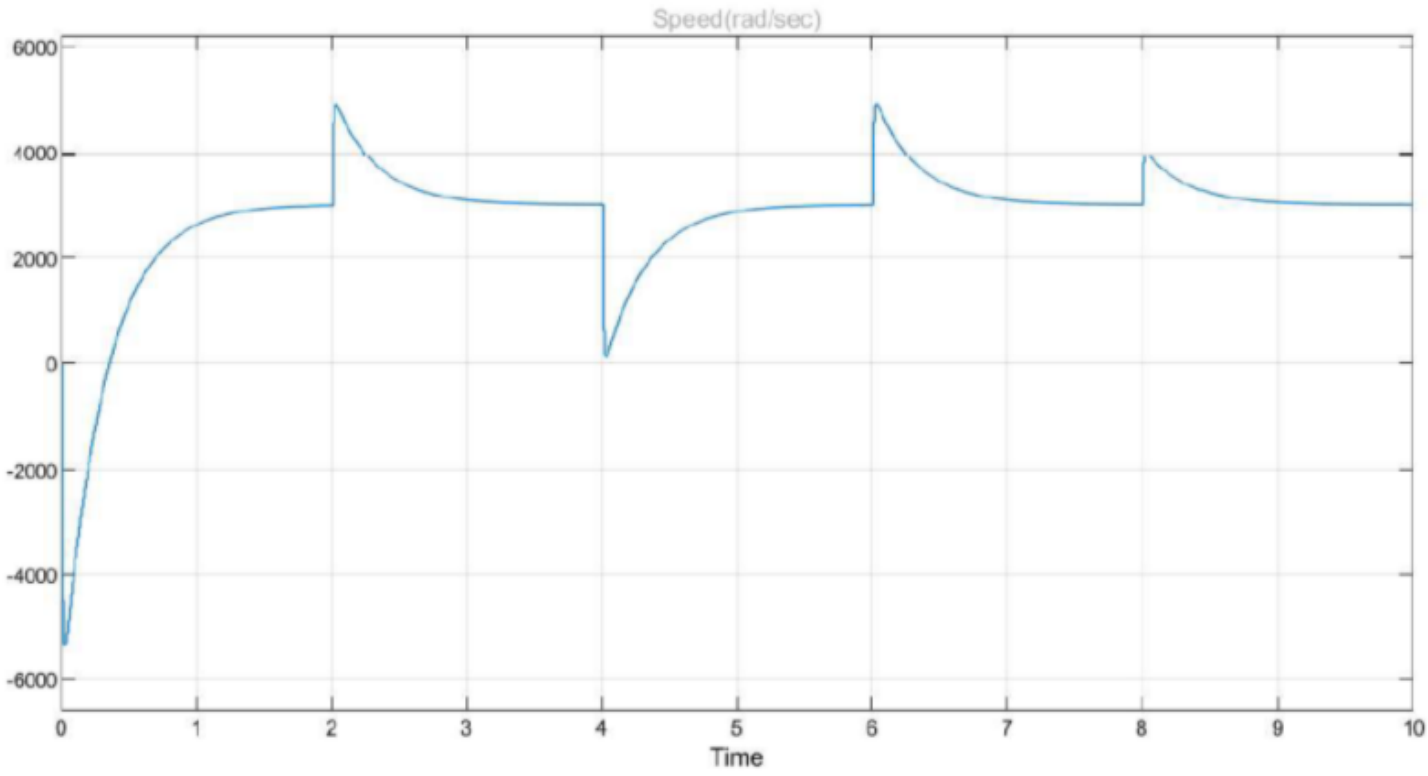
Speed (rad/s) vs time



CONCLUSION

We successfully simulated the DC motor with PID controller (discrete-time) and obtained the above speed characteristics.

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