Analog Motor Control

ELP 225

http://web.iitd.ac.in/~deepakpatil/elp225.html

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MOTIVATION

- DC Motor is widely used in industries and traction, and requires a speed control module for operation.

- PID controller, a classical control method stands for Proportional (P) Integral (I) Derivative (D) control action, has been extensively used in industry for simplicity and “adequate” performance till date [1,2].

- The controller encompasses three fundamental mathematical manipulations to achieve the desired performance. It is interesting to study how these effect the system performances.

[1] The Modern Industrial Workhorse: PID Controllers, https://www.techbriefs.com/component/content/article/tb/features/articles/20013, Accessed: 2018/07/22
[2] Blevins, Terrence L. "PID advances in industrial control." *IFAC Proceedings Volumes* 45.3 (2012): 23-28.

OBJECTIVES

- To control the speed of DC Motor using P and/or I and/or D and/or controller.
- To control the position of DC Motor using PI, PD, and PID controller.
- To analyse the transient response and steady-state performance for PID controller.
- To study the robustness of PID towards disturbance applied through change in load.

SYSTEM DESCRIPTION

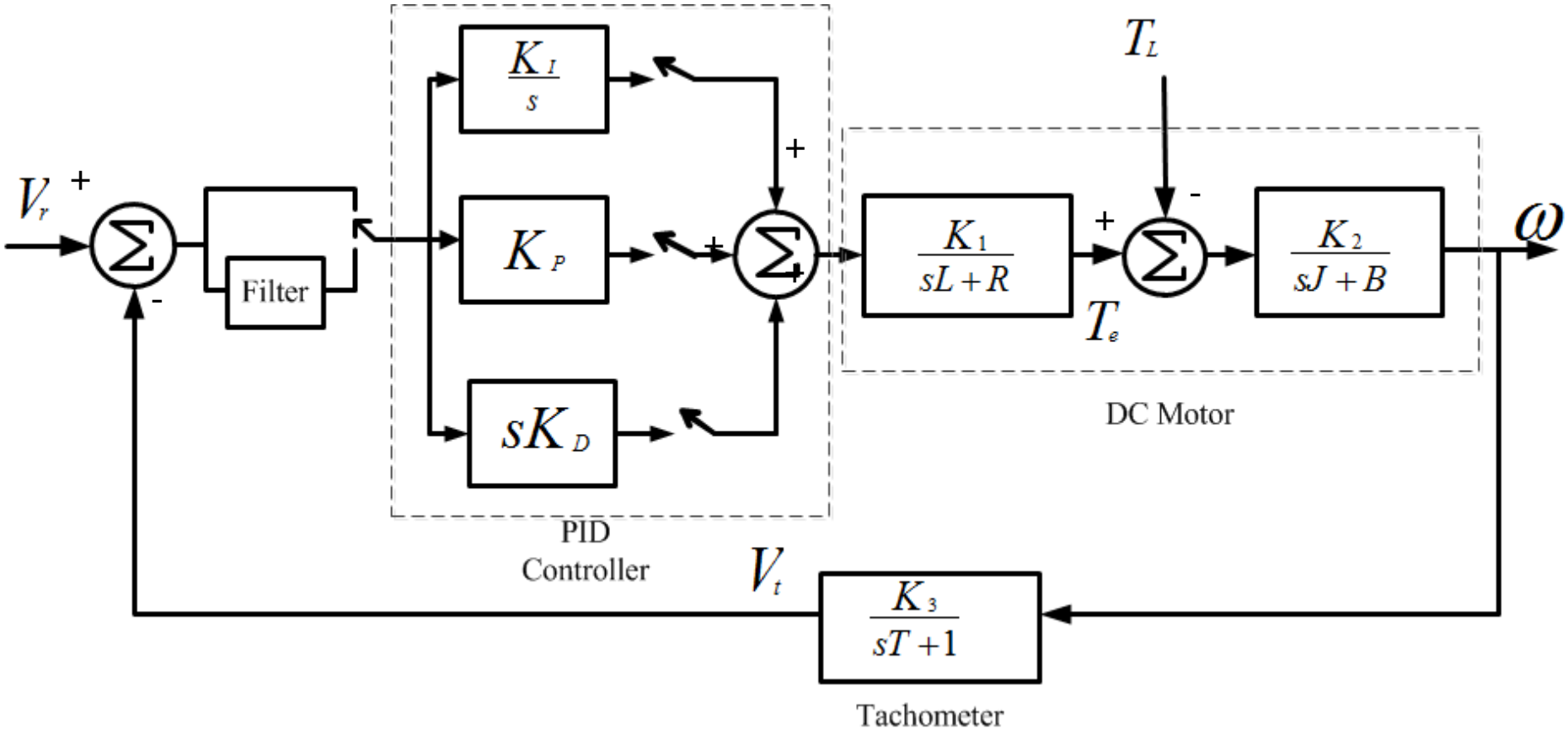

Fig A typical block diagram for Speed Control of DC Motor with PID

Questions

- Is there any reason for not using integral action only to control the position?
- What changes occur in a system response when derivative action is added to proportional plus integral (PI) control?
- Why damping effect occurs when proportional plus integral (PI) control is applied?
- When do system exhibits sustained oscillation in the system response?
- What happens when a sinusoidal input is applied to proportional plus integral control?

- Whether the derivative actions can impose any limitations to the controller performance?
- Can a PID Controller, depending the upon the active control actions, be described as lead or lag or lead-lag compensator?
- Although the closed loop system with P control is of second order (or more), why we do not observe any oscillations with increase in proportional gain?
- Can we realize an ideal PID? Is it a causal system?
- Are there any standard rules of PID tuning?
- Is there any trade-off?

Try this!

- To simulate the experimental setup of DC Motor speed and position control using PID. A nice tutorial is given in [3]

[3] DC Motor Speed: PID Controller Design, http://ctms.engin.umich.edu/CTMS/index.php?example=MotorSpeed&section=ControlPID Accessed on 2018/07/22a