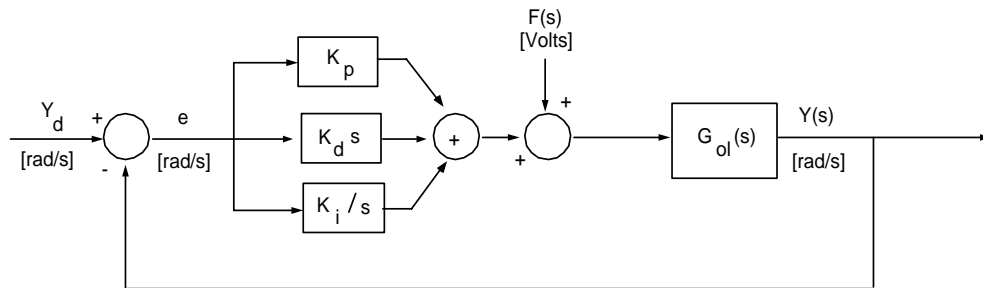


Homework – System ID and PID

Due Next Week – No Electronic Copies will be graded

1. Capture a 2.5 Volt step input response for your motorized tethered cart. Include the following:
 - A. Graph of cart velocity in radians/sec versus time in seconds (10 points)
 - B. What is the steady-state velocity Y_{ss} in radians/sec? (5 points)
 - C. What is the steady-state gain k in radian/Volt-second? (5 points)
 - D. What is the time constant τ in seconds? (5 points)
 - E. What is the open-loop transfer function? (5 points)
2. In LabVIEW, simulate a 2.5 Volt step input response using the transfer function identified above. Compare your graph to the experimental one captured above. Include hardcopies of your Front Panel and Block Diagram (20 points)
3. Given that the open-loop transfer function $G_{ol}(s) = \frac{b}{s+a}$ and the PID block diagram given as:



Given a step input $Y_d = \frac{A}{s}$, derive the steady-state response y_{ss} for the following:

- A. Proportional only control (5 points)
 - B. Proportional + Integral control (10 points)
 - C. Proportional + Derivative control (10 points)
4. In LabVIEW implement a PID simulation of the block diagram given in Question 3 and using the open-loop transfer function of your motorized tethered cart identified in Question 1. Find a set of PID gains that meet the following performance criteria: no overshoot; no steady-state error; and τ less than 0.1 seconds. Include hardcopies your Front Panel and Block Diagram and simulated output (25 points)