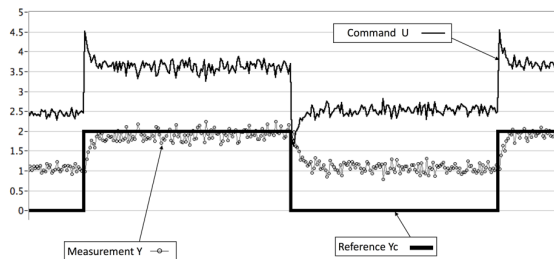


MOOC TP- evaluation examples, v 2017

Sample questions from previous years.

By looking at screenshot of the oscilloscope window you should be able to quickly determine:

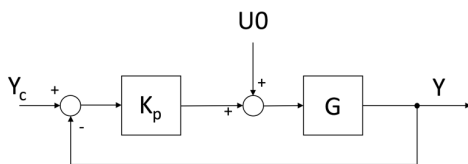
- if the system is in open/closed loop
- if you measure the speed or the position
- the structure of the controller, if any



closed-loop
speed measurement
could be P + U0 or PI

1a. Is the motor always rotating, justify ?

Yes because Y (speed measurement) is >0



1b. What is the value of the command U0 and the gain Kp, justify ?

$U = U0 + Kp(Yc - Y) \rightarrow U0 \sim 3.5, Kp \sim 1$

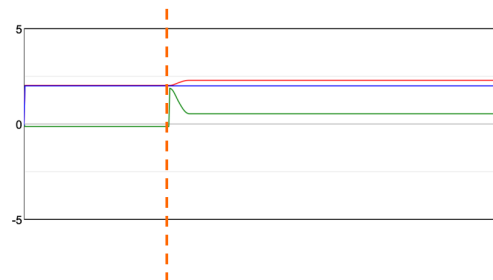
Y : measurement - red, U : command - green, Yc : reference - blue



closed-loop
speed measurement
PI

2. Why is the response to a negative step faster than the response to a positive one, justify ?

The command saturates for the positive step while not for the negative one.



closed-loop
position measurement
P

3. We apply a constant perturbation to the system (line). What is the type of the implemented controller? Justify.

We control the position; the constant perturbation is not rejected
 $\rightarrow$ no integrator in the controller $\rightarrow$ P controller



closed-loop
position measurement
P

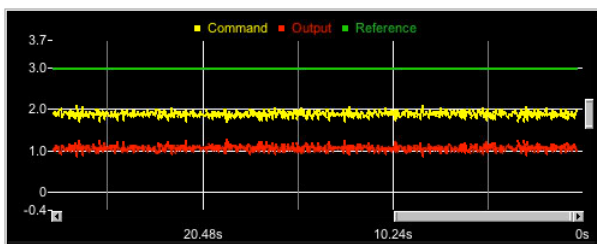
4a. What is the gain of the controller, justify ?

We control (badly) the position,
steady state errors due to friction -> P controller
-> $U = K_p e = K_p (Y_c - Y)$

$$\rightarrow K_p = U / (Y_c - Y) = -0.677 / (-2 - (-1.3)) = \sim 1$$

4b. Suggest an improvement for controller in question 3, justify ?

Increase K_p or add an integral term



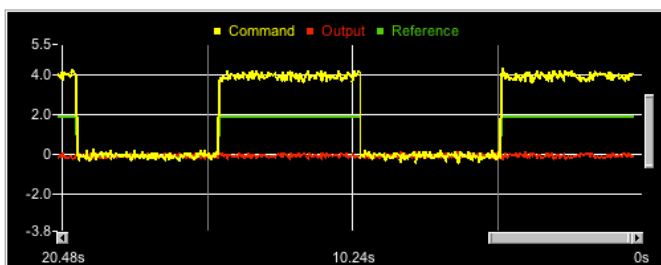
closed-loop
speed measurement

5a. A P controller is used. What value has the gain K_p ? Justify.

$$K_p = \text{cmd} / e = \text{cmd} / (\text{ref} - \text{out}) = 1.9 / (3 - 1.1) = 1.9 / 1.9 = 1$$

5b. What is the static gain of the system, assuming a friction of 0.6 [v]? Justify.

$$K = \text{out} / \text{cmd}' = \text{out} / (\text{cmd} - \text{frot}) = 1.1 / (1.9 - 0.6) = 0.84$$



closed-loop
speed measurement

1.a. The electrical drive is defective, suggest a cause.

Not moving due to any causes (friction, belt, actuator, no power, ...)

1.b. What is the controller gain? Justify.

$$u = k_p * e = k_p * (y_c - y) \rightarrow k_p = u / (y_c - y) = 4 / (2 - 0) = 2$$