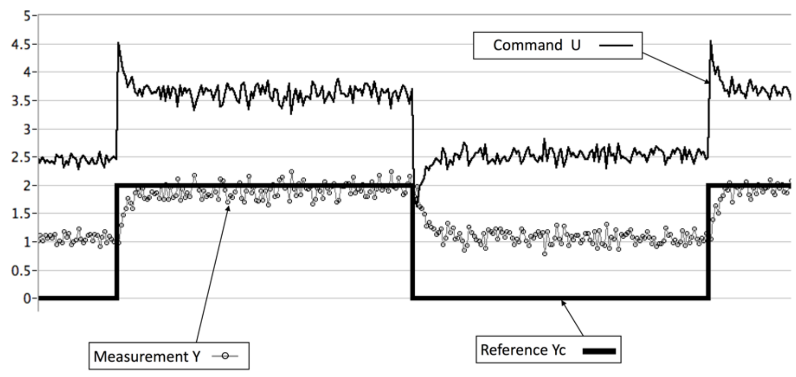
MOOC TP- evaluation examples, v 2017b

Sample questions from previous years.

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

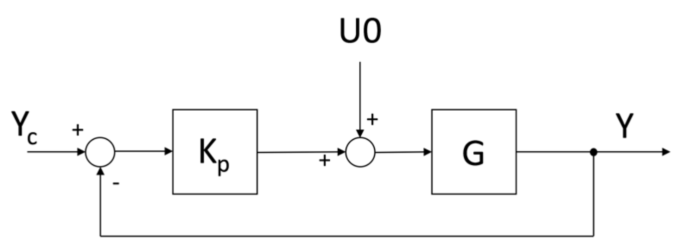
- if the system is in open/closed loop
- if you measure the speed or the position
- the structure of the controller, if any



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

1a. Is the motor always rotating, justify ?

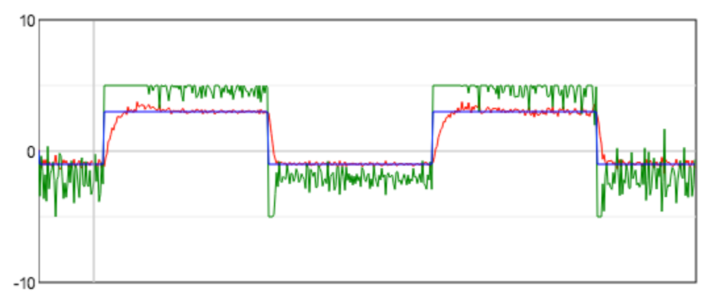
Yes because Y (speed measurement) is >0



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

U = U0 + Kp (Yc-Y) -> U0 ~3.5, Kp ~1

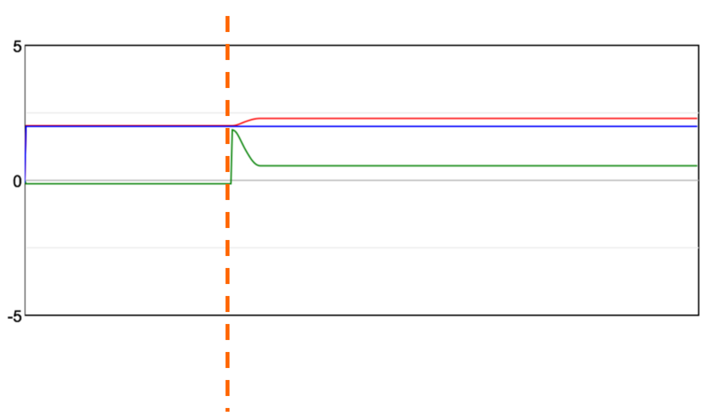
Y :measurement - red, U : command - green, Yc : reference – blue



closed-loop
speed measurement
PI

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

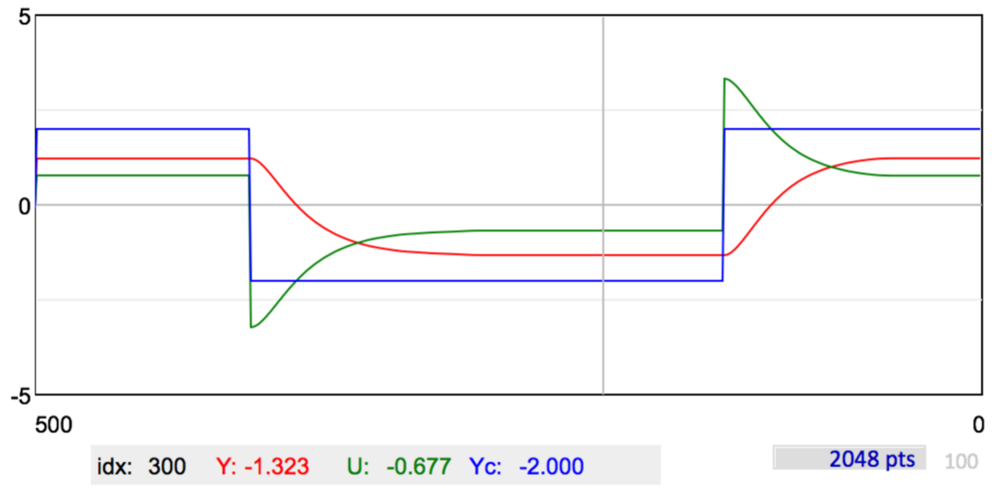
The command saturates for the positive step while not for the negative one.



closed-loop
position measurement
P

3. We apply a constant perturbation (U0 = 2v) to the system (line).
What is the type of the implemented controller? Justify.
Note: cmd U (green) represent the voltage applied to the motor,
i.e. controller cmd + FF command (if any)

We control the position; the constant perturbation is not rejected
-> no integrator in the controller -> P controller



closed-loop
position measurement
P

Note: the friction zone is in +/- 0.8 [v]

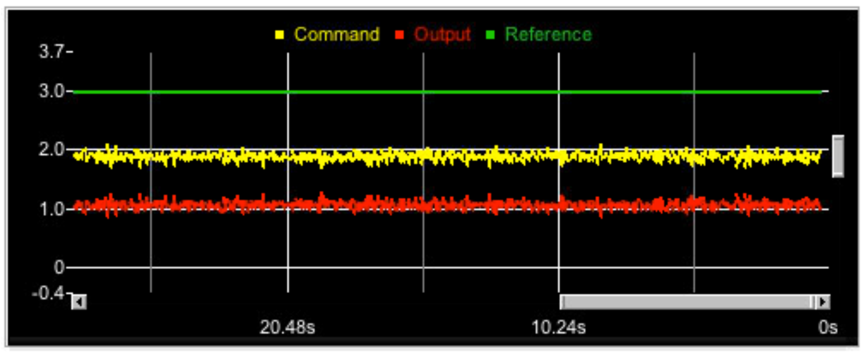
4a. *What is the gain of the controller, justify ?*

We control (badly) the position,
steady state errors due to friction (0.8v) -> P controller
-> U = Kp e = Kp (Yc – Y)

-> Kp = U / (Yc – Y) = -0.677 / (-2 – (- 1.3)) = ~1

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

Increase Kp or add an integral term



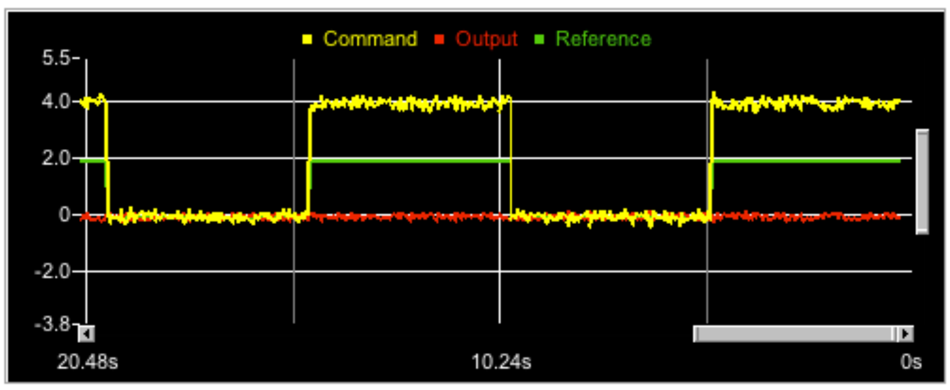
closed-loop
speed measurement

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

Kp=cmd/e = cmd / (ref-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 = out / cmd' = out / (cmd – frot) = 1.1 / (1.9 - 0.6) = 0.84



closed-loop
speed measurement

1.a. *The electical 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.*

$u=k_p * e = k_p * (y_c – y)$ -> $k_p = u/(yc – y) = 4 /(2-0) = 2$