1 PD control / 2nd order system

b

In this exercise a PD controller is used to control the plant $G(s) = \frac{1}{s(1+2s)}$ as shown in the figure below:

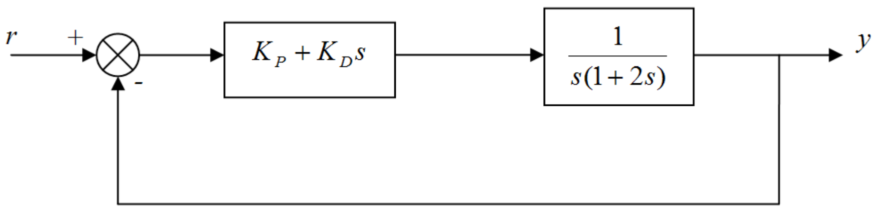


Figure 1: Closed-loop control of $G(s)$ using a PD controller

The desired specifications are given by:

- Settling time $t_s \approx 4$ seconds $(2\%\ criterion)$
- Overshoot $M_p \approx 15\%$

The appropriate gains K_P and K_D that satisfy these specifications are:

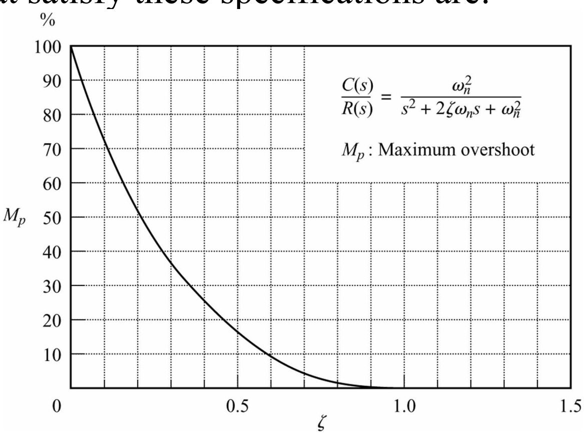
a) $K_P = 4$ and $K_D = 1$

b) $K_P = 8$ and $K_D = 3$

c) $K_P = 16$and $K_D = 7$

d) $K_P = 32$ and $K_D = 11$

e) None of the above



2 Routh [redacted]

Consider the block diagram given in the figure below:

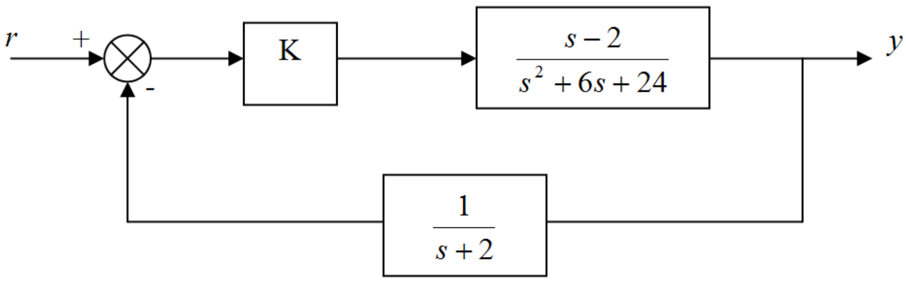


Figure 2: Block diagram

Using Routh criterion, we found that to ensure the stability of the system the controller K should be:

a) $K \leq -24$

b) $-24 \leq K \leq 0$

c) $-24 \leq K \leq 24$

d) $0 \leq K \leq 24$

e) $K \geq 24$

3 Steady state error [redacted]

Given is the block diagram of a robotic vehicle as shown in the figure below.

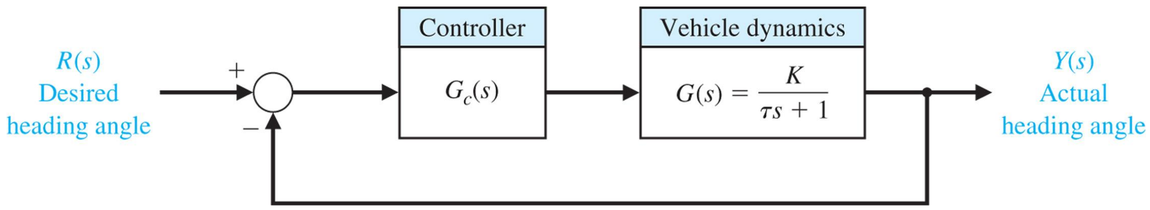


Figure 3: Robotic vehicle control

The following parameters of the block diagram are given:

- Gain $K = 0.5$
- Controller $G_{\mathrm{c}}(s) = K_1 + \frac{K_2}{s}$

Determine the static velocity error constant. Determine K_2 such that the steady state error to a ramp input $w_{\mathrm{d}} = \frac{1}{s}$ is $e_{\mathrm{ss}} = 0.01$.

a) $K_2 = \frac{0.02}{\tau}$

b) $K_2 = 0.02$

c) $K_2 = \frac{200}{\tau}$

d) $K_2 = 200$

e) none of the above

4 True or false [redacted]

The final value theorem is only applicable for stable systems

a) True

b) False

5 True or false [redacted]

A state space model is a unique representation of a dynamic system

a) True

b) False

6 True or false [redacted]

It is not possible to eliminate steady state error with open loop control

a) True

b) False

7 True or false [redacted]

A system of “Type 1” has zero steady state error in response to a step input

a) True

b) False