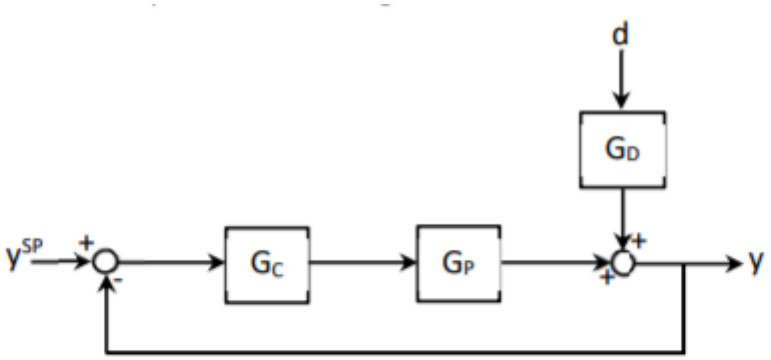
Lab Report 4(170747)

The following SISO process is given to us



where

$$G_P = \frac{2.5}{(5s+1)(2s+1)(s+1)(0.5s+1)}$$

$$G_D = \frac{1}{(10s+1)(5s+1)(2s+1)(s+1)}$$

$$G_C = K_C\left(\frac{\tau_I s+1}{\tau_I s}\right)\left(\frac{\tau_D s+1}{0.1\tau_D s+1}\right)$$

Using the root locus technique, we obtained the controller gain, Kc for a P, PI and PID controller, such that the dominant closed loop characteristic equation roots have ξ = 0.5. For a PI and PID controller, heuristic of setting **Ti=5** and **Td=0.5**, respectively, the largest and the smallest time constant of the process transfer function Gp was used.

1. <u>For P Controller</u>

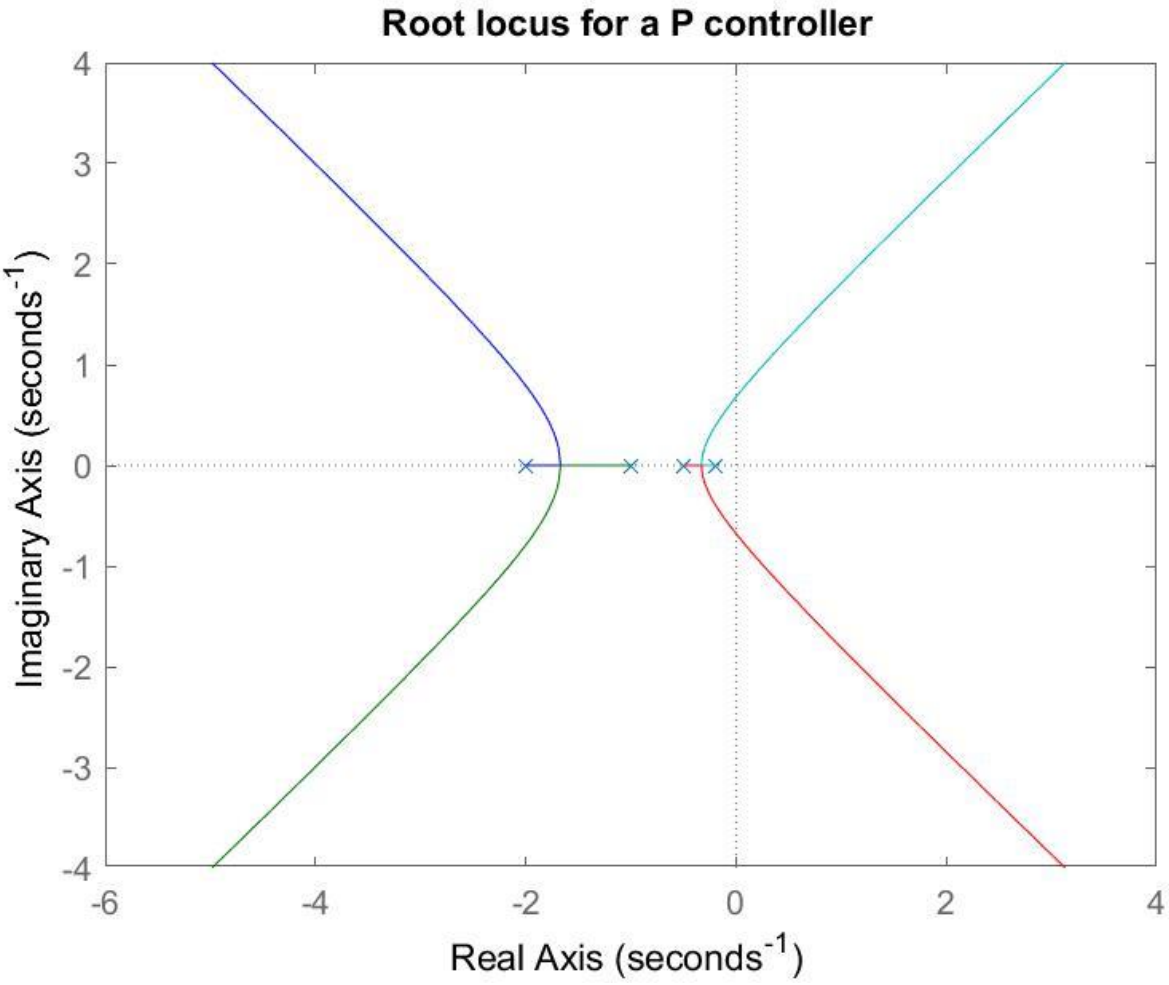
The controller settings obtained were for a damping coefficient of 0.5:

Kc=0.546

Ti=1e10

Td=1e-10

S = -0.211 + 0.367 i



2. For PI Controller

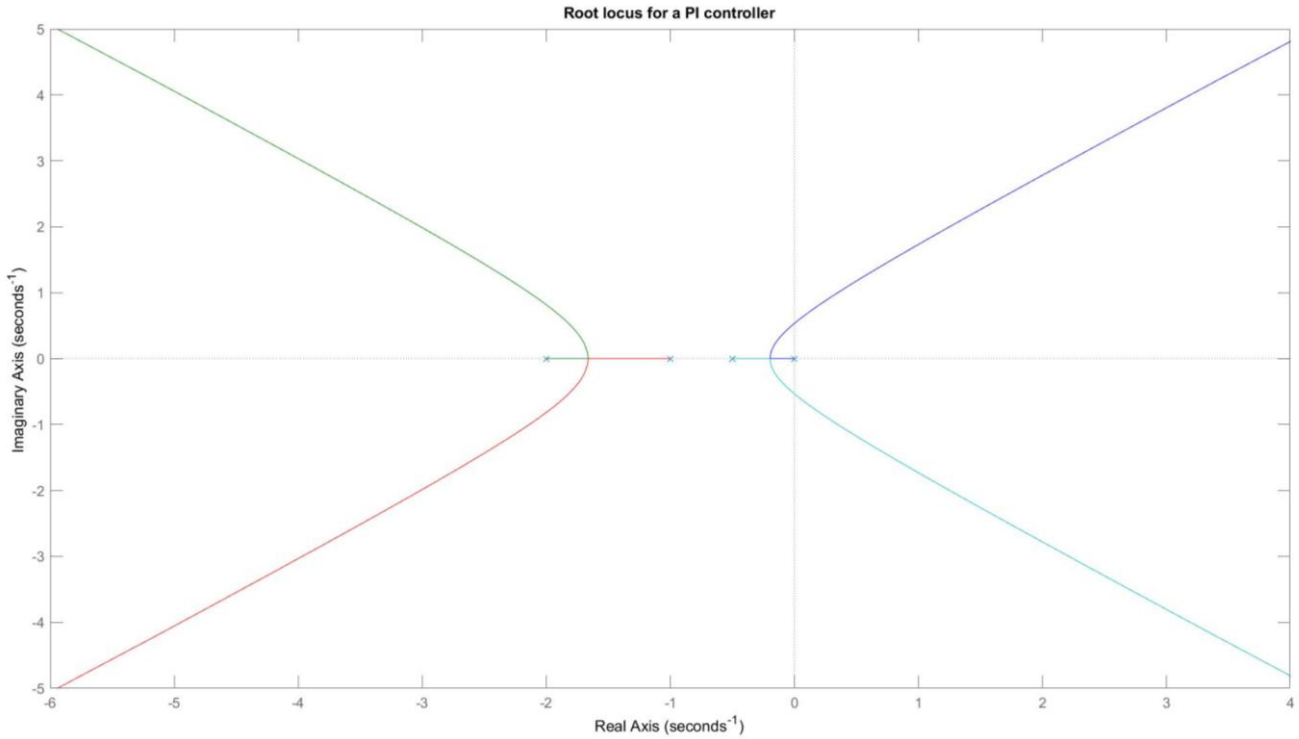
The controller settings obtained were for a damping coefficient of 0.5:

Kc=0.425

Ti=5

Td=1e-10

S = -0.146 + 0.254 i



3. For PID Controller

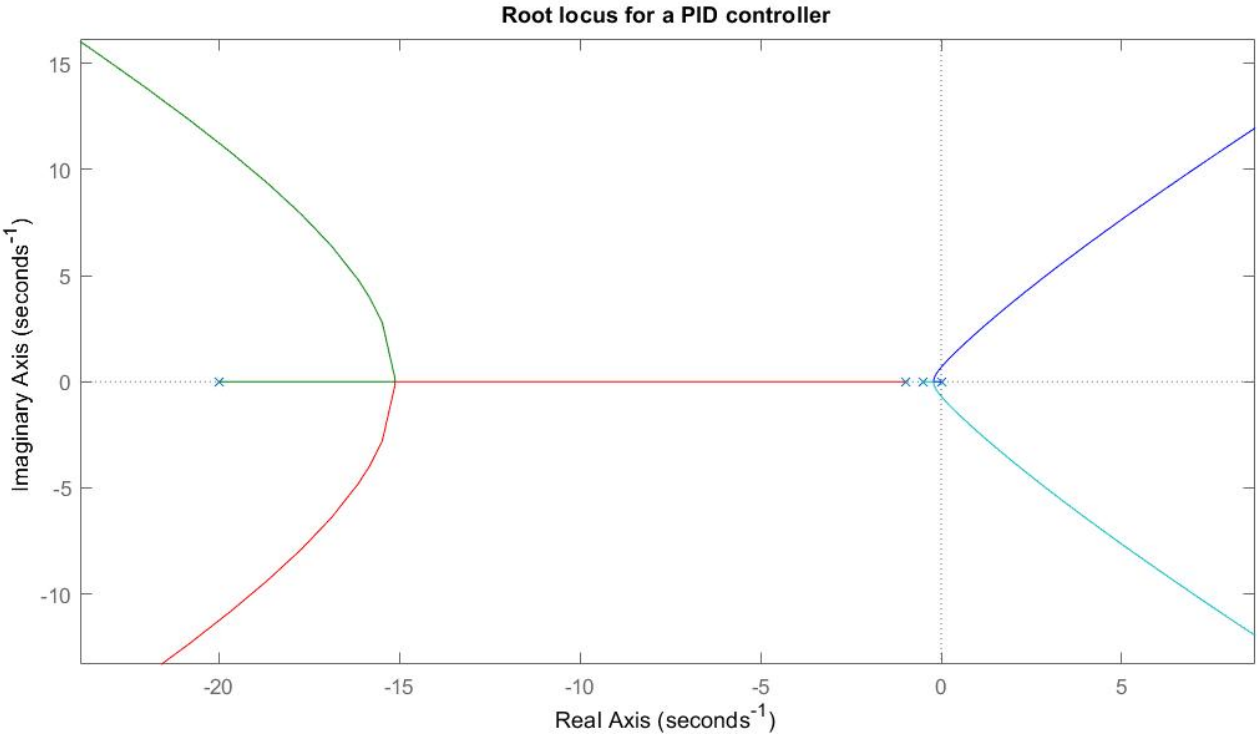
The controller settings obtained were for a damping coefficient of 0.5:

Kc=0.505

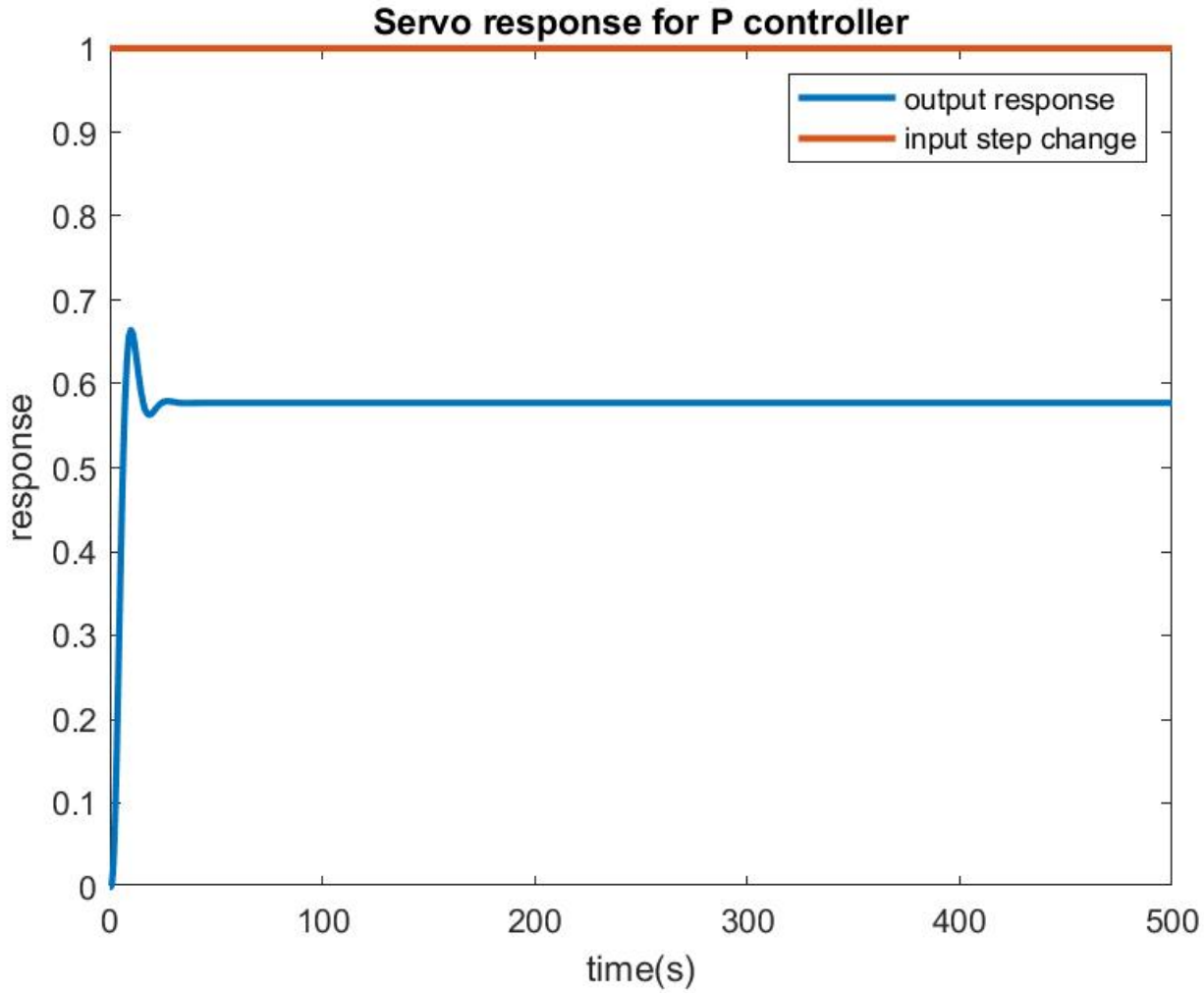
Ti=5

Td=0.5

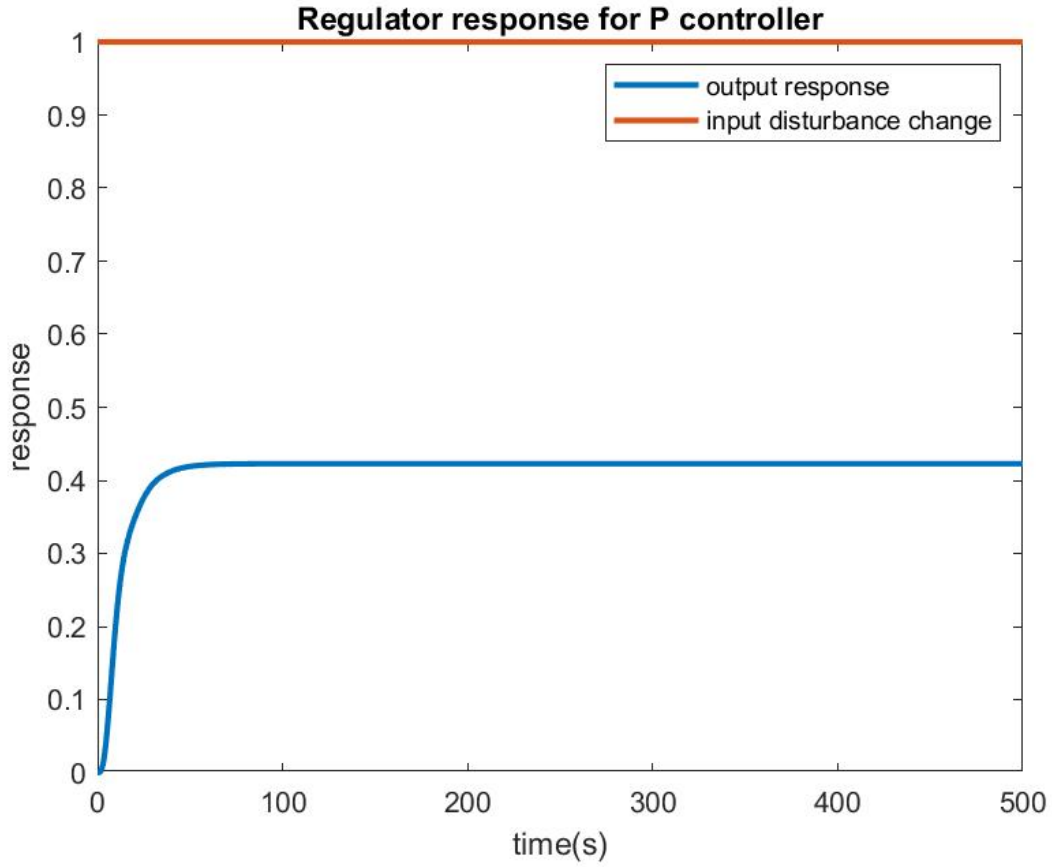
S = -0.164 + 0.284 i



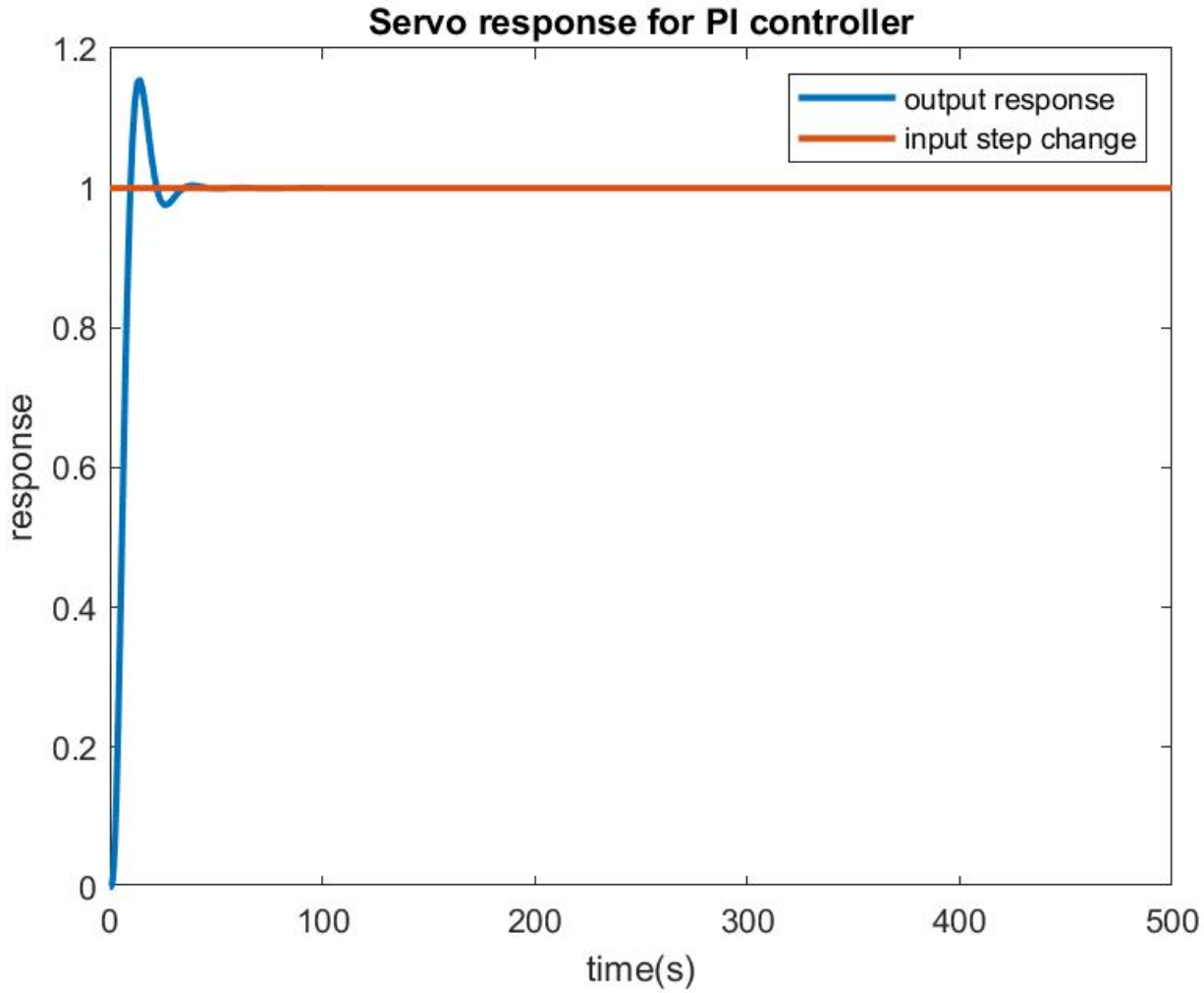
Servo Response for P controller for the tuning obtained above



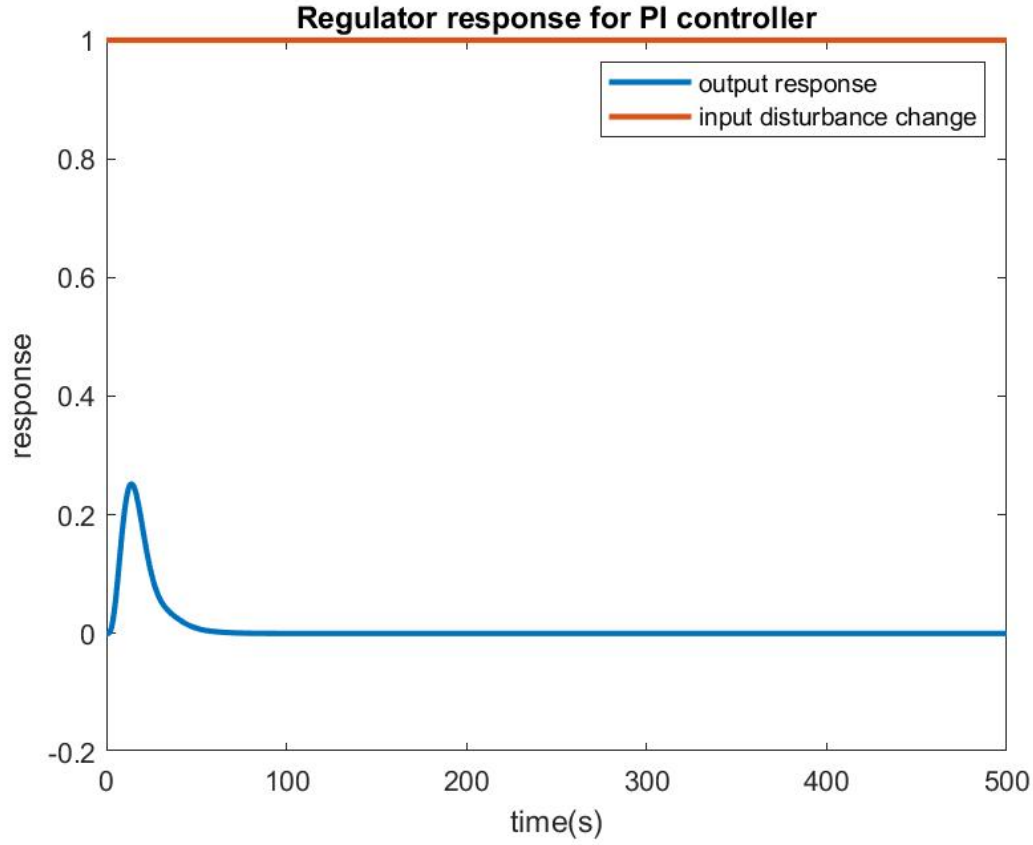
Regulator Response for a P controller for the tuning obtained above



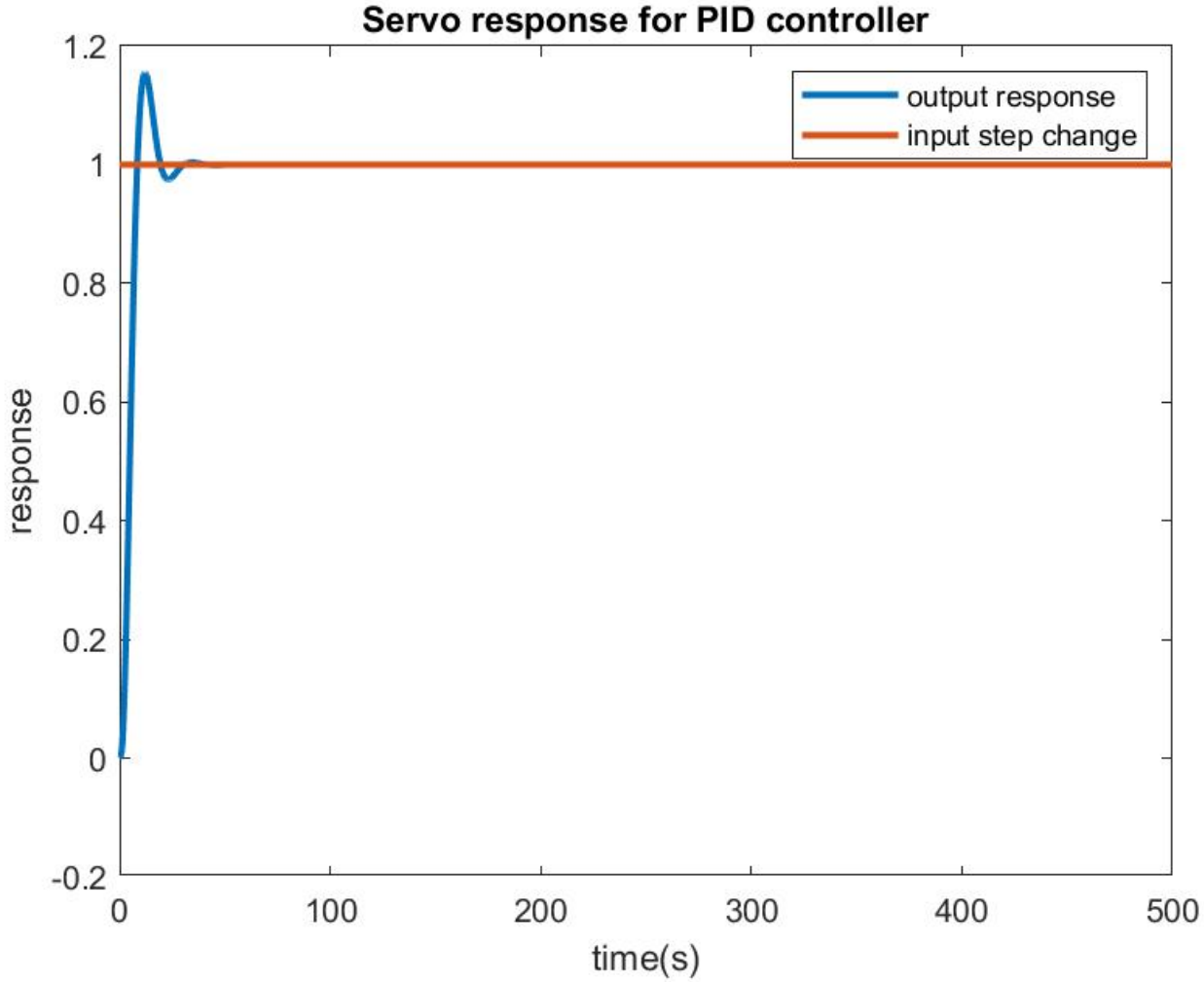
Servo Response for PI controller for the tuning obtained above



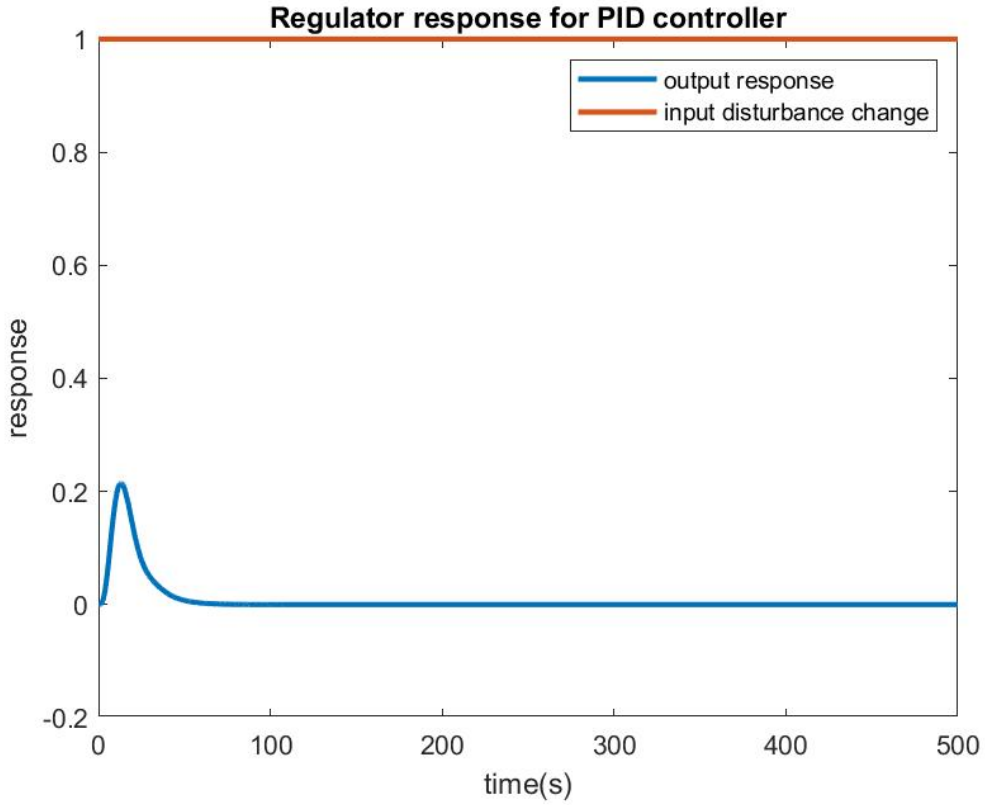
Regulator Response for PI controller for the tuning obtained above



Servo Response for PID controller for the tuning obtained above

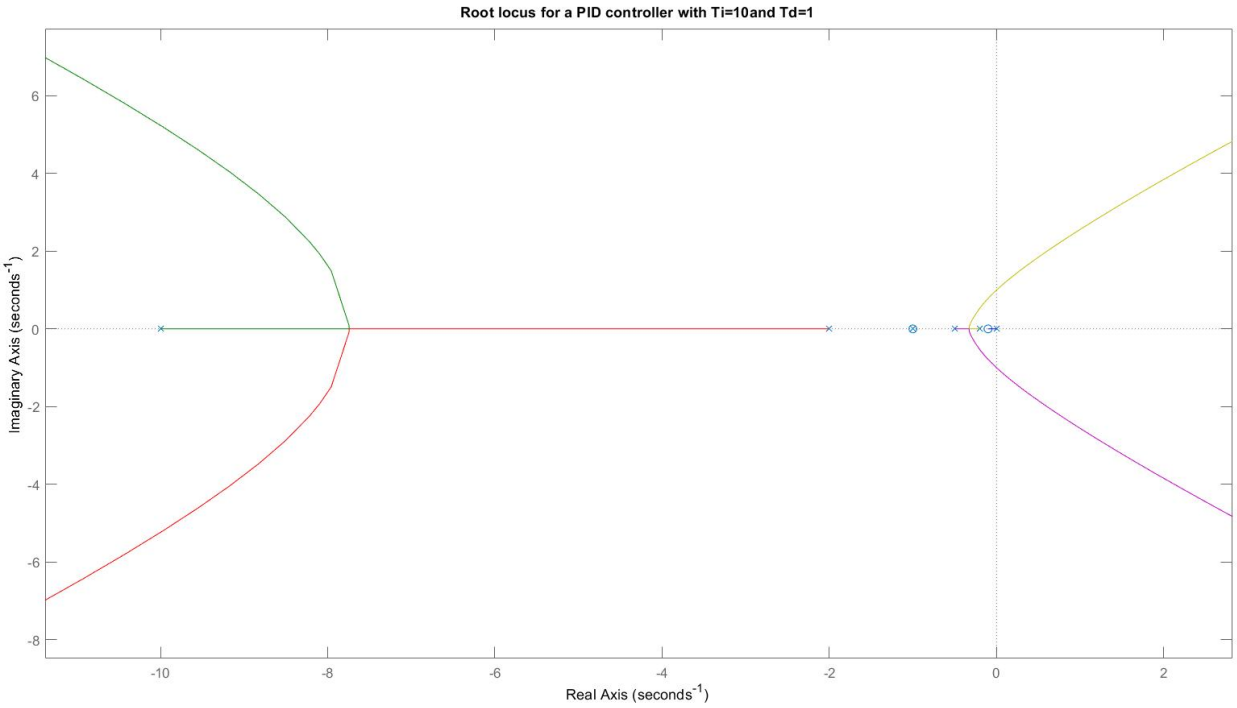


Regulator Response for PID controller for the tuning obtained above

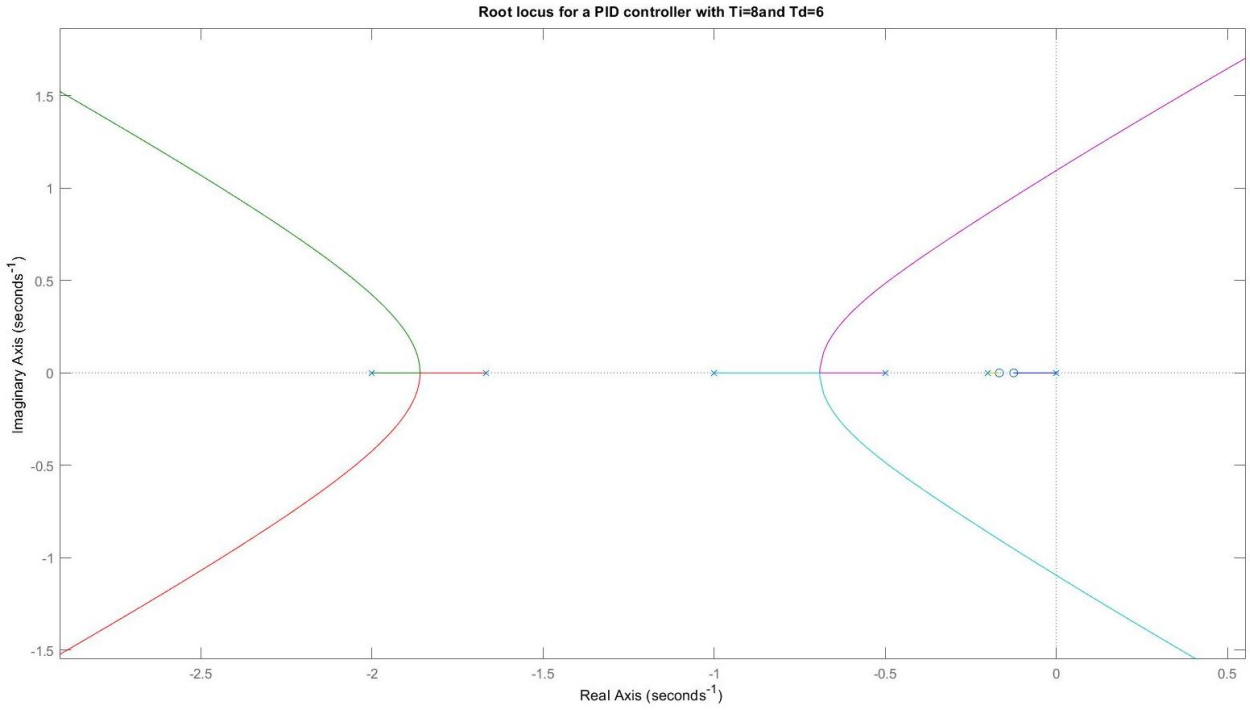


Root locus with different values of Td and Ti

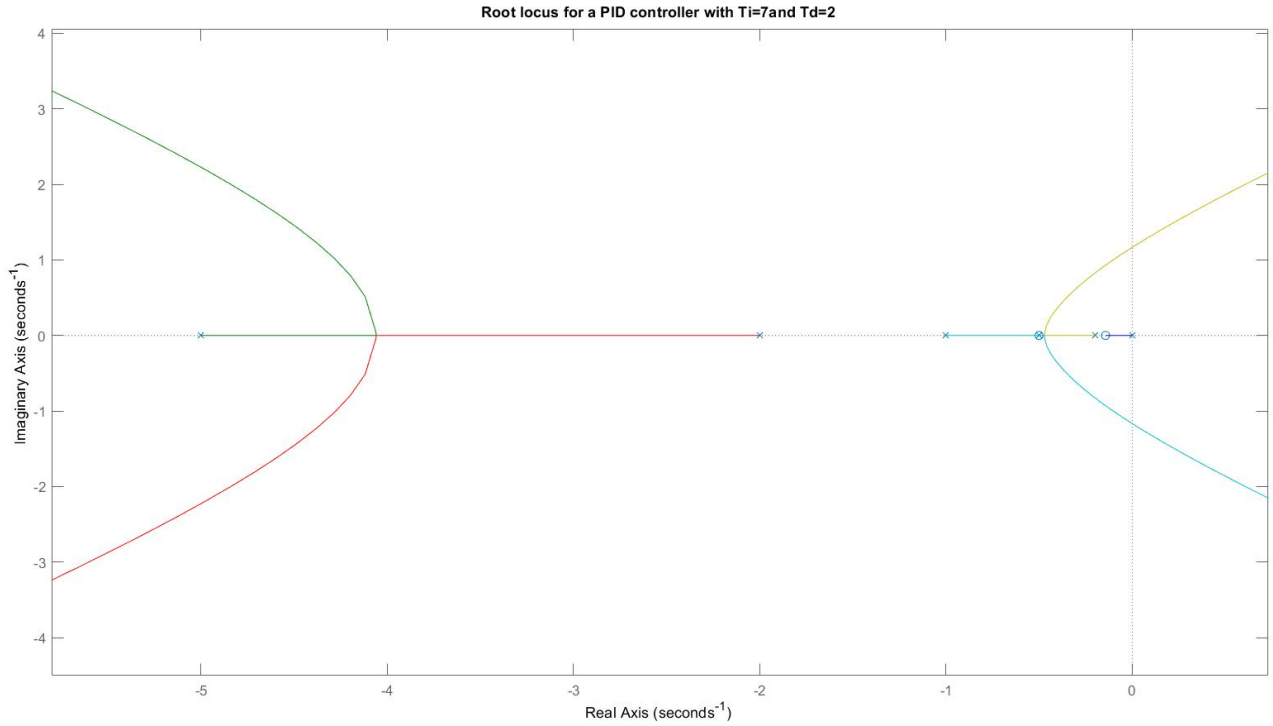
Ti=10 and Td=1



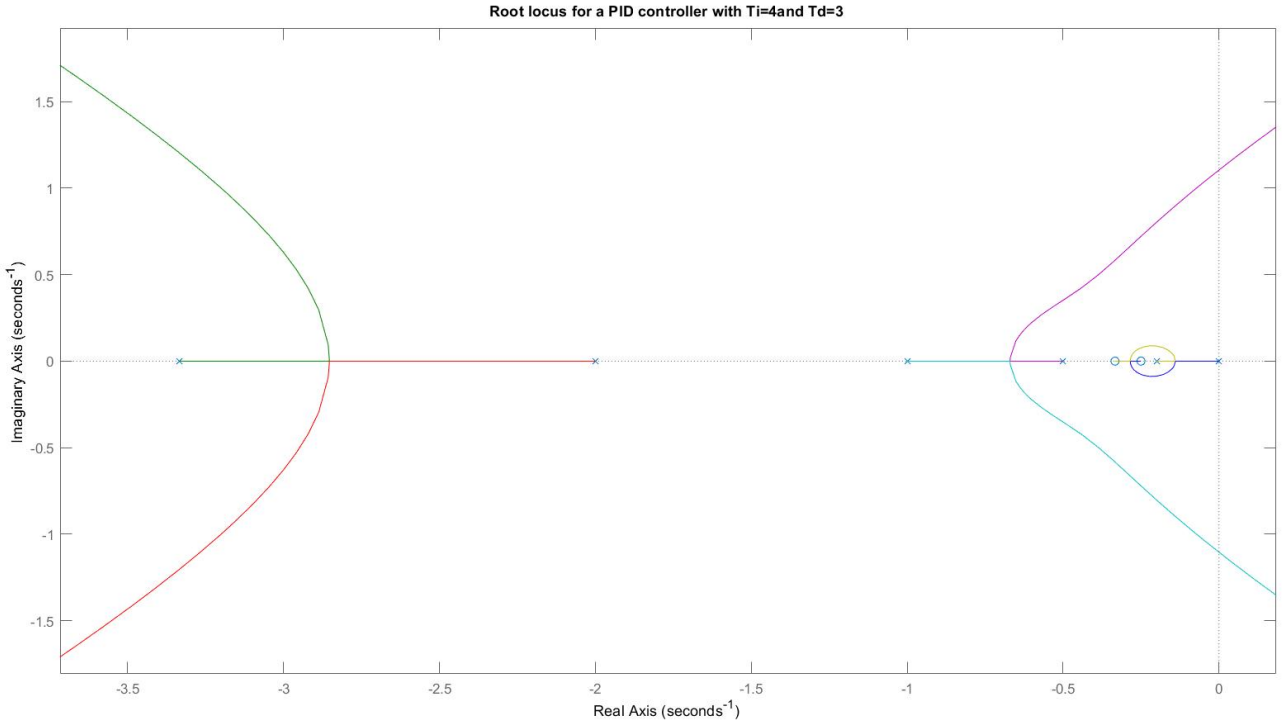
Ti=8 and Td=6



Ti=7 and Td=2



Ti=4 and Td=3



Conclusion

The heuristics for choosing Ti and Td make sense because it reduces the number of poles and zeros and thus increases the chances of stability.