

Computer Exercise 1

EL2520 Control Theory and Practice

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April 5, 2023

Disturbance attenuation

How should the extra poles be chosen in exercise 4.2.1? Motivate!

To make the controller proper, two additional poles have to be added. We placed both poles at $p_{1,2} = -10$ to minimize the effect while not impacting controller performance.

The feedback controller in exercise 4.2.2 is

$$F_y(s) = \frac{s+18}{s} G^{-1} G_d \frac{100^2}{(s+100)^2}$$

The feedback controller and prefilter in exercise 4.2.3 is

$$F_y(s) = K \frac{\tau_1 s + 1}{\beta \tau_1 s + 1} F_{y,4.2.2} = 0.8507 \frac{0.0832s + 1}{0.0416s + 1} \frac{s+18}{s} G^{-1} G_d \frac{100^2}{(s+100)^2}$$

$$F_r(s) = \frac{1}{1 + \tau_2 s} = \frac{1}{1 + 0.1s}$$

Did you manage to fulfill all the specifications? If not, what do you think makes the specifications difficult to achieve?

We managed to achieve a rise-time of 0.1347 s while having an overshoot of 8.78% . As you can see in Figure 1, the response on a step disturbance also fulfills the given criteria. Figure 2 shows the reference step that achieves the performance mentioned above. Figure 3 shows the control signal when a step in r , d or both, is applied. As one can see, the controller ensures that $|u| < 1$.

Finally, Figure 4 shows the bode diagrams of the resulting sensitivity and complementary sensitivity functions.

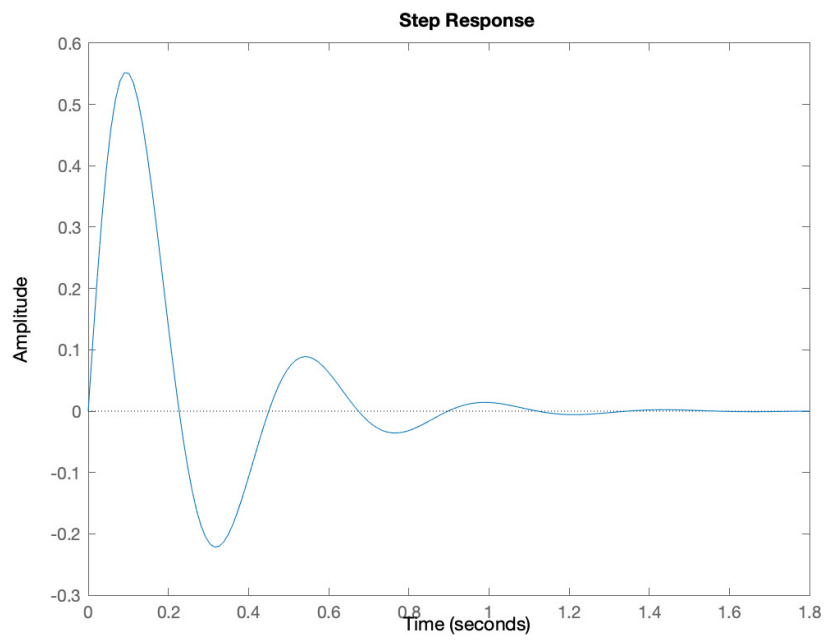


Figure 1: Step disturbance, exercise 4.2.2

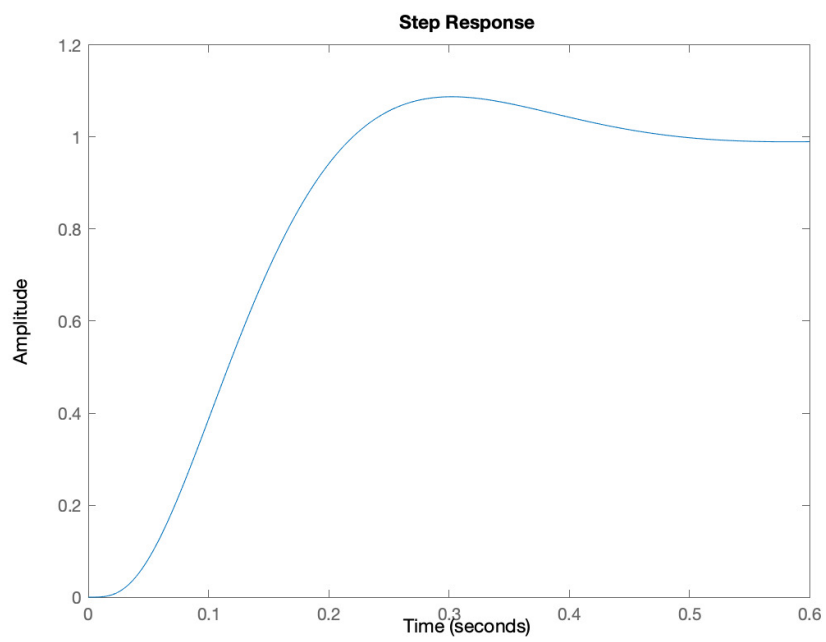


Figure 2: Reference step, exercise 4.2.3

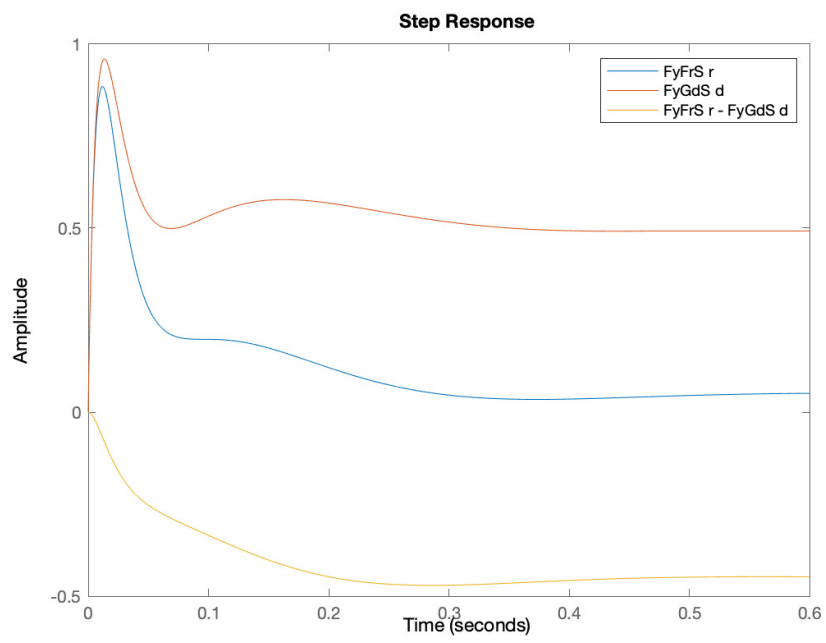


Figure 3: Control signal for a disturbance or a reference step (plus a combination of these)

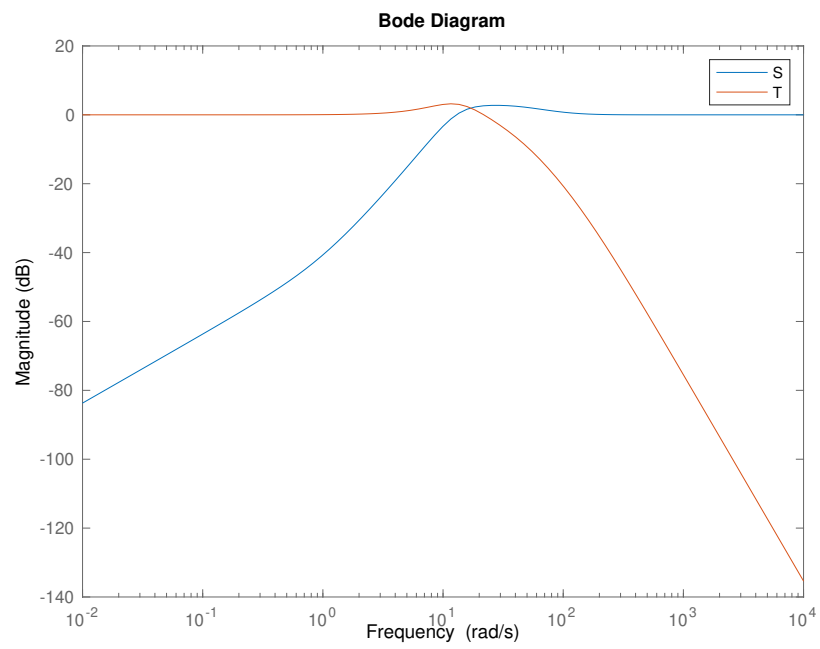


Figure 4: Bode diagram of sensitivity and complementary sensitivity functions, exercise 4.2.4