MF2007 - Workshop B

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Task 1

Level 1

Task 2: Writing Controller Code

Level 1

The code equivalent to the Simulink blocks gave similar results which can be seen in Figure 1 and Figure 2. A sampling time of 10 ms was used for the code. Different sampling times were tested and it was noticed that when using a higher sampling time the impact on the trajectory planner increased. When a higher sampling time is used the change of acceleration is missed by a few milliseconds and therefore impact the velocity and position. This gives the difference in the position of the motor which is seen in Figure 2.

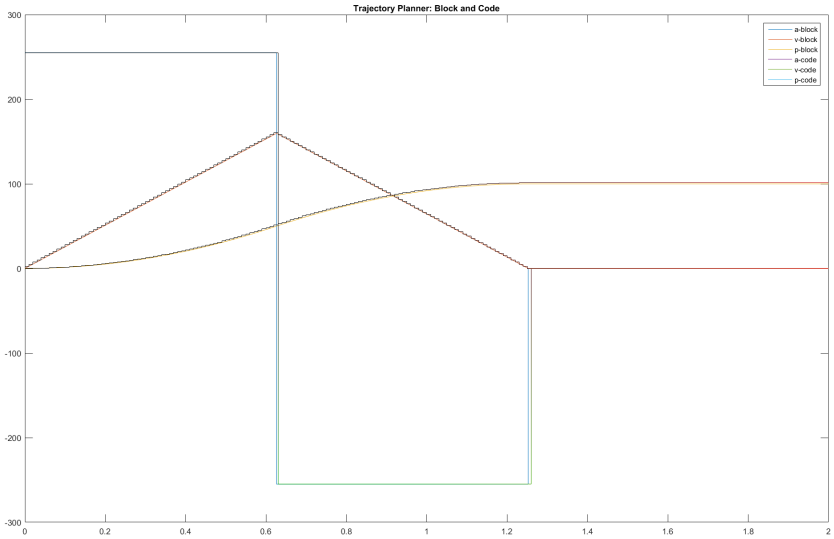

Figure 1: Trajectory planner signal comparison

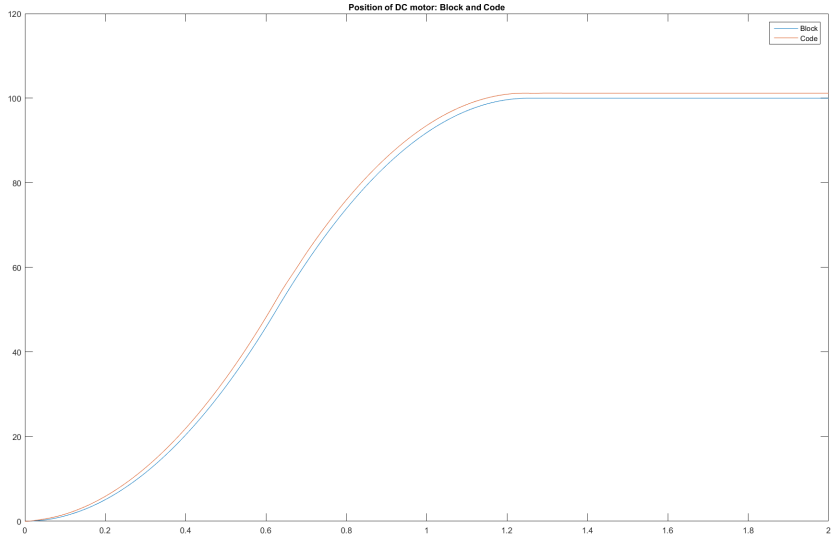

Figure 2: Motor position comparison

A close-up of the sampling time problem is shown in Figure 3. When the velocity increases it the code signal follows the curve perfectly but when the change in acceleration happens the velocity code signal gets "out-of-sync".

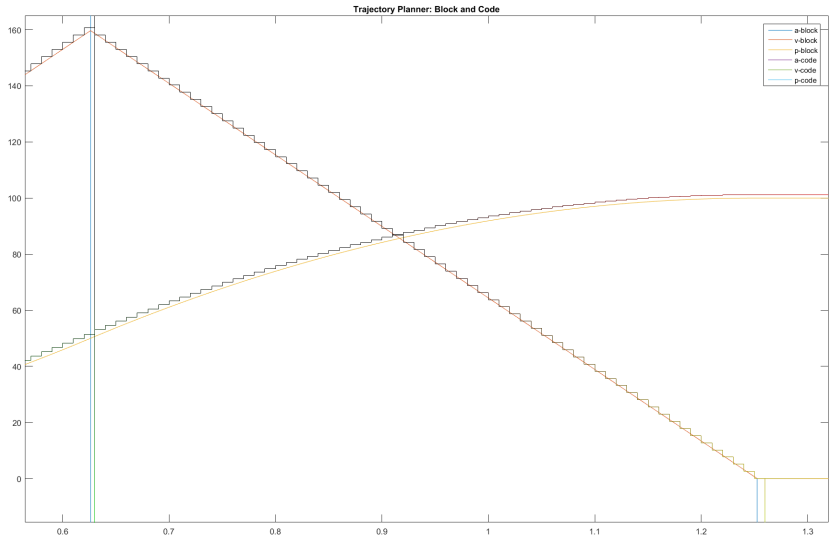

Figure 3: Close-up of trajectory planner signal

Task 3: Robustness to parameter uncertainty and sensor noise

Since the plant have a transfer function as,

$$G_o(s) = \frac{25.15}{s + 2.157} \tag{1}$$

and an $A_m(s)$ of same order should be chosen, the following functions is used,

$$A_m(s) = s + \omega_1$$
$$A_o(s) = s + \omega_2$$

with

$$\omega_1 = 10$$
$$\omega_2 = 5$$

These values gives the plot seen in figure 4

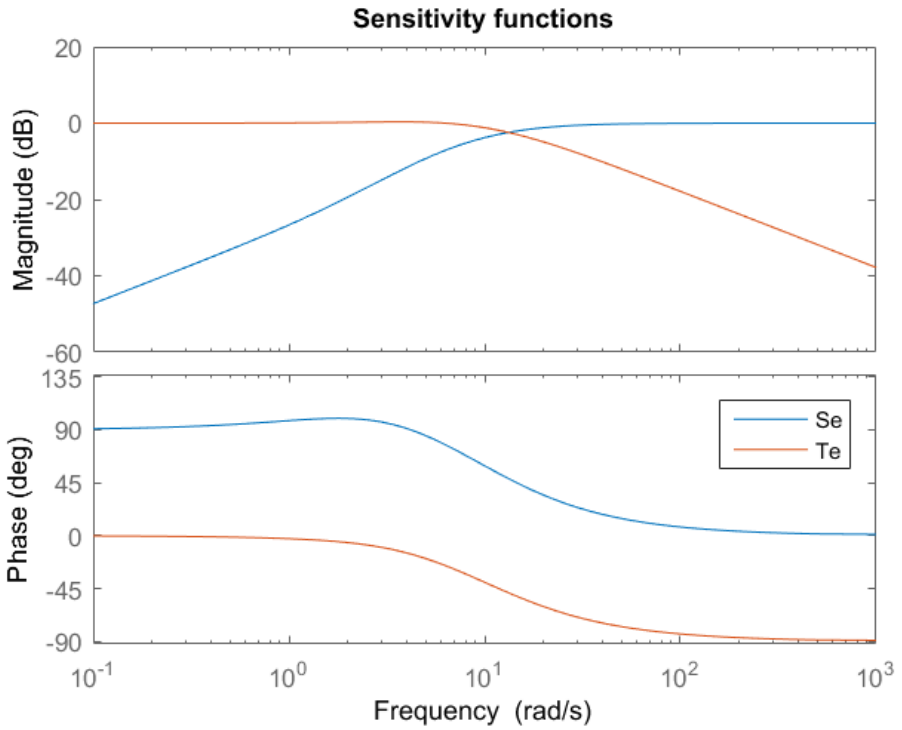

Figure 4: The sensitivity and conmplementary sensitivity function

when the poles for $A_0(s)$ is increased to five times $A_m(s)$ the results in figure 5 is obtained.

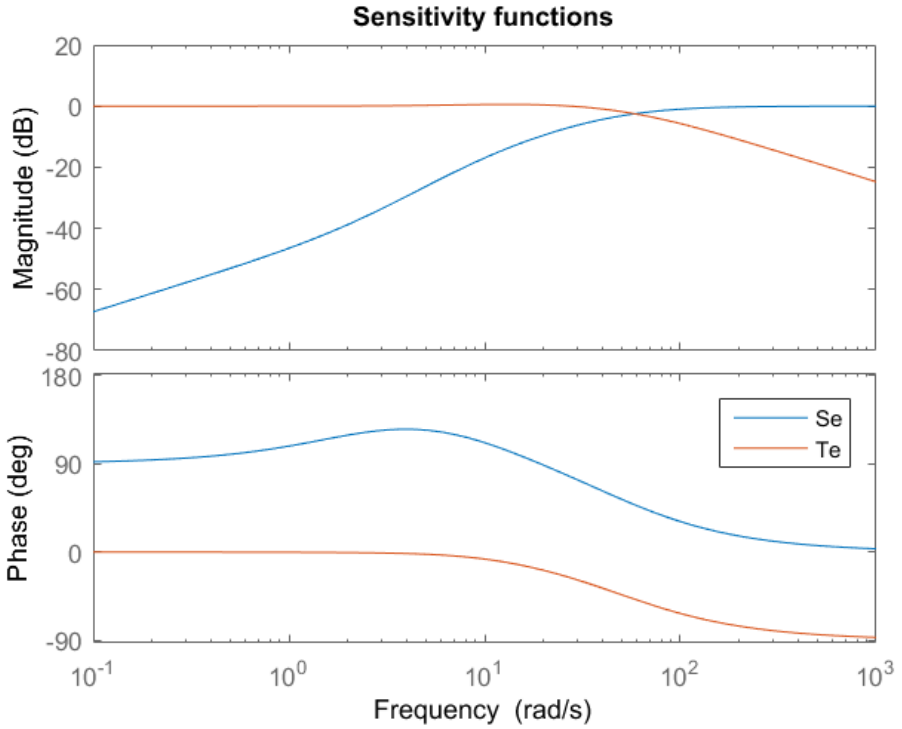

Figure 5: S_e and T_e with five times faster $A_o(s)$ poles

From the plots we can see that there is a possibility to adjust the system to be less sensitive to noise and disturbances from either the sensor or the plant. This means that if there is a good plant model, there is more room for sensor noise.