1.a,b

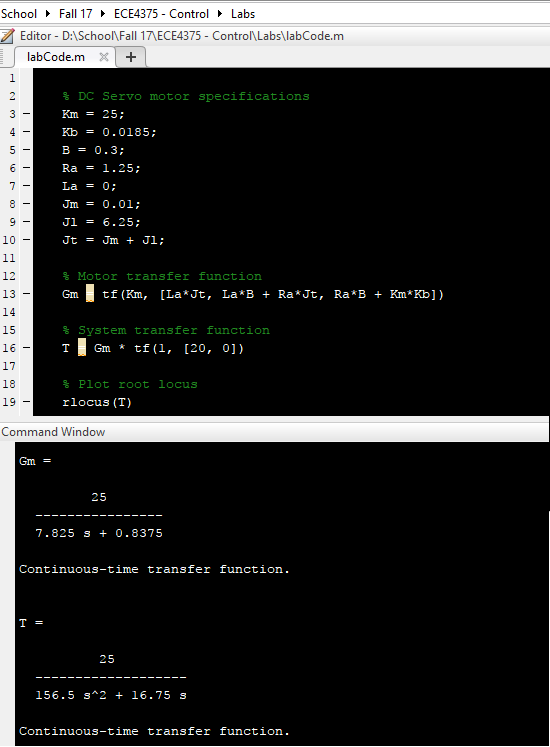


Figure MatLab calculation of transfer functions

1.c

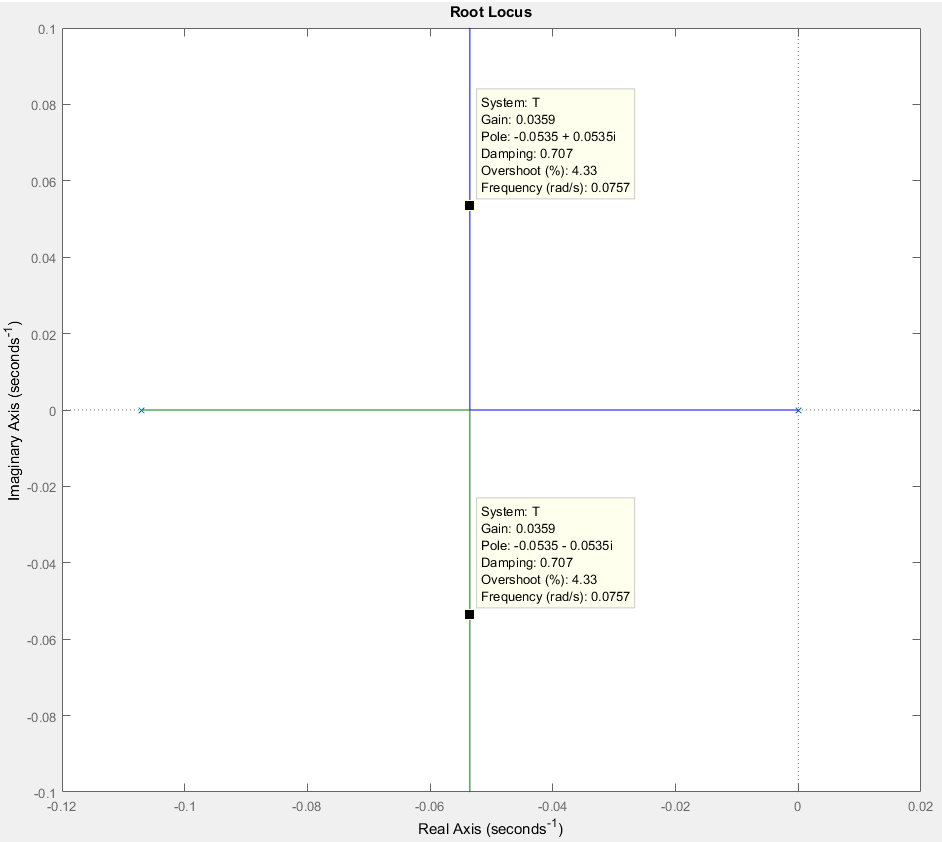


Figure MatLab Root Locus Plot

1.d KP = 0.0359

1.e

1.f

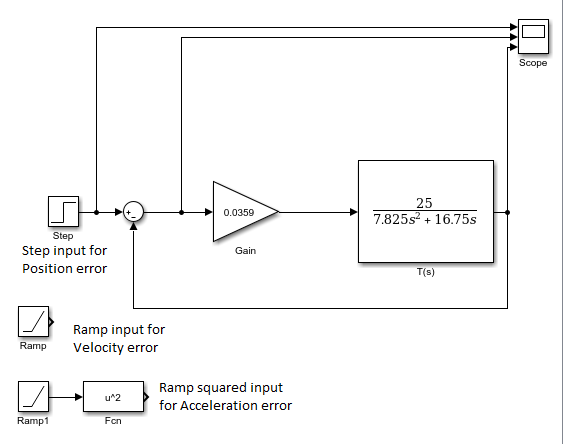


Figure Simulink Block Diagram

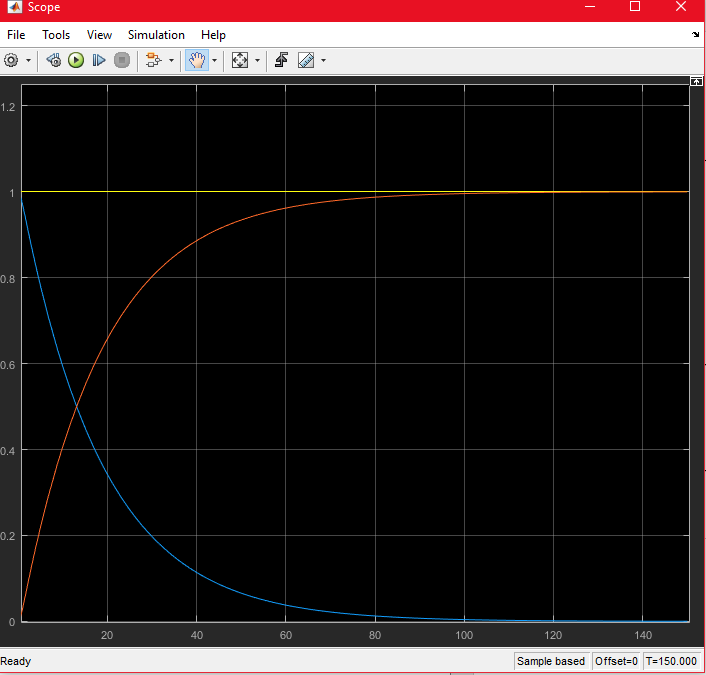


Figure Static Position error. Yellow: Input, Orange: Output, Blue: Error.

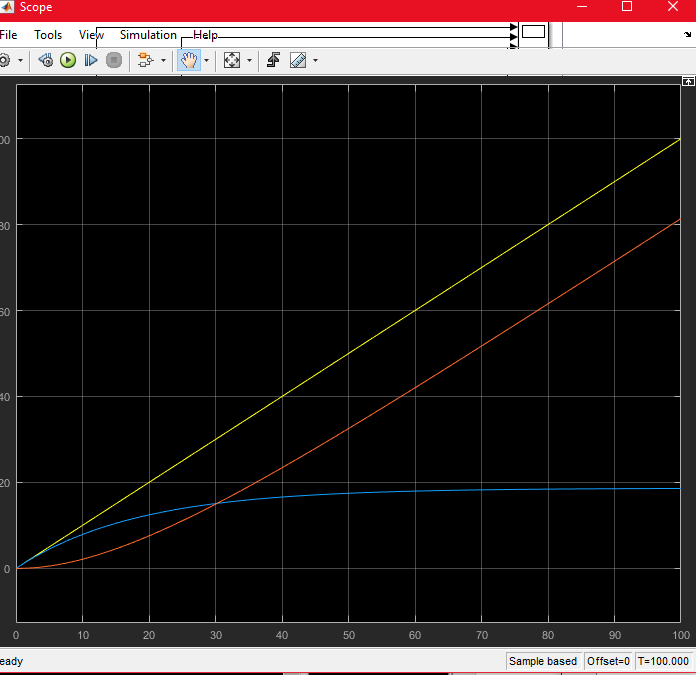


Figure Static Velocity Error. Yellow: Input, Orange: Output, Blue: Error

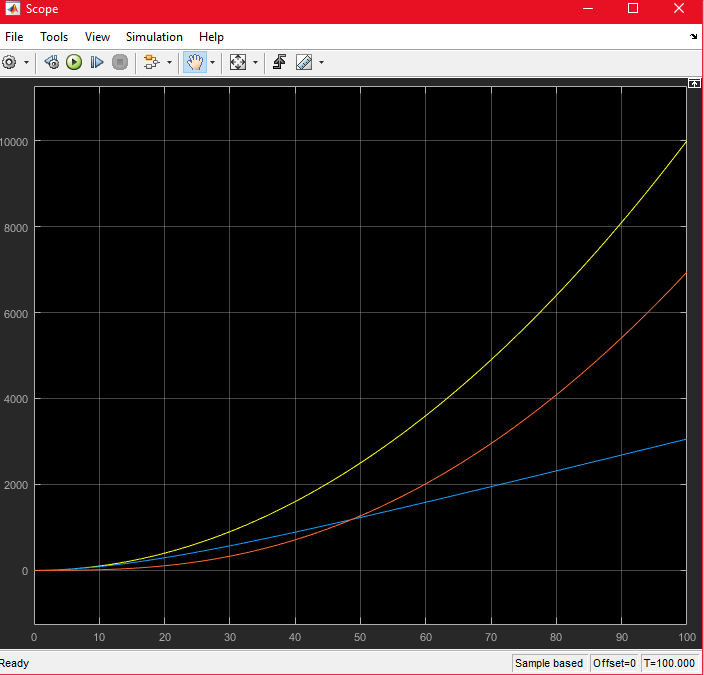


Figure Static Acceleration Error. Yellow: Input, Orange: Output, Blue: Error.

a.

Controller in (d) has less overshoot and less oscillation, so unless you want the system to reach a target value quicker, the controller in (d) performs better.

b.

The gearbox reduces the motor output by a factor of 20

c.

The output of the system oscillates at the same frequency as the input, but experiences greater attenuation at higher frequencies.

2

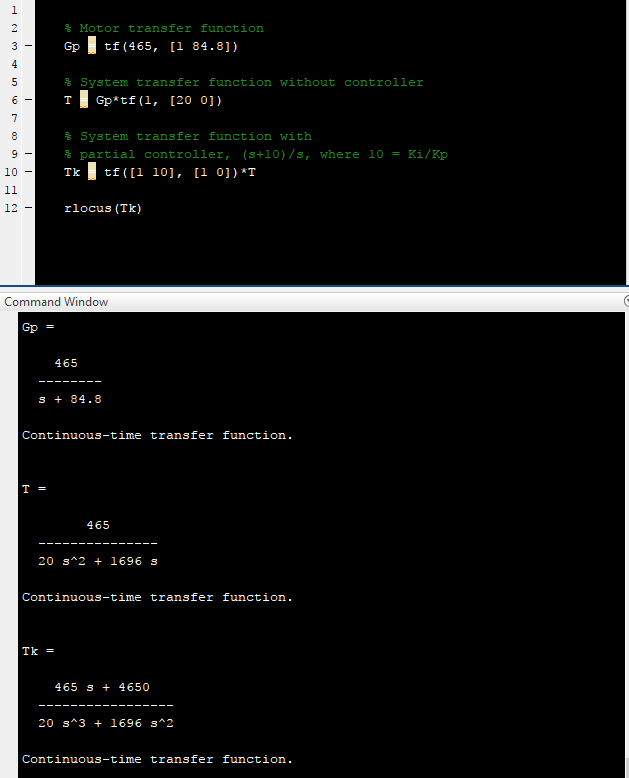


Figure Matlab code for transfer functions

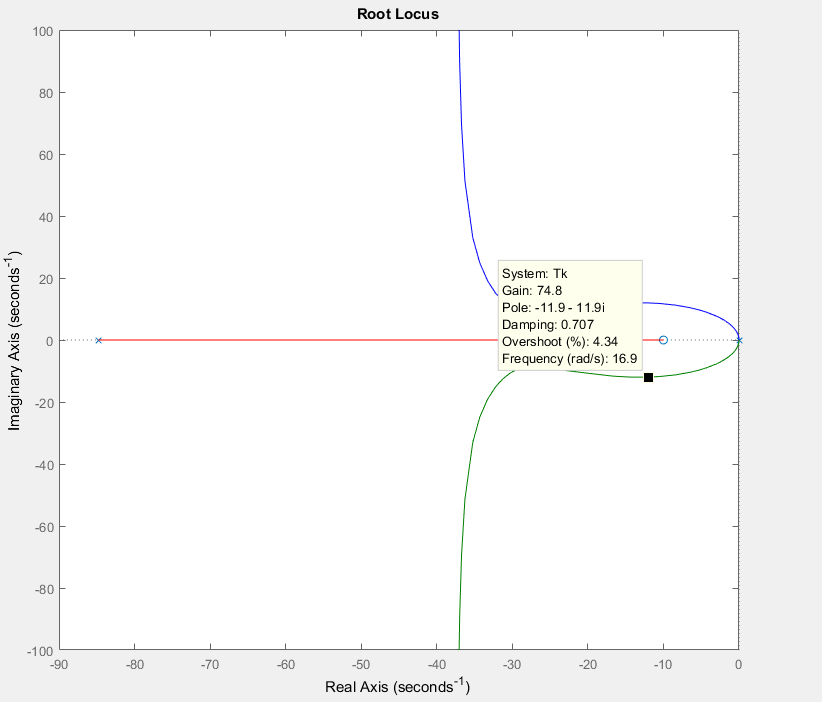


Figure Root Locus Plot

(a)

KI/KP was chosen to be 10, resulting in:

and

So

(b)

For KI/KP = 10:

Then

(c)

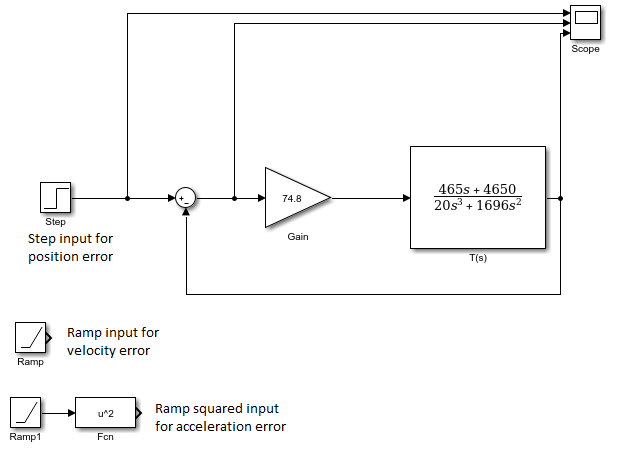


Figure Simulink diagram for static error plots

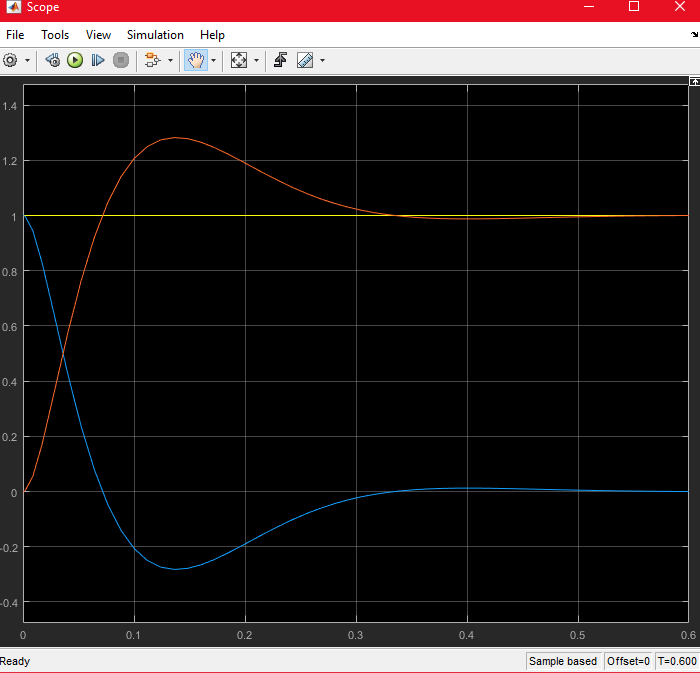


Figure Static Position error. Yellow: Input, Orange: Output, Blue: Error.

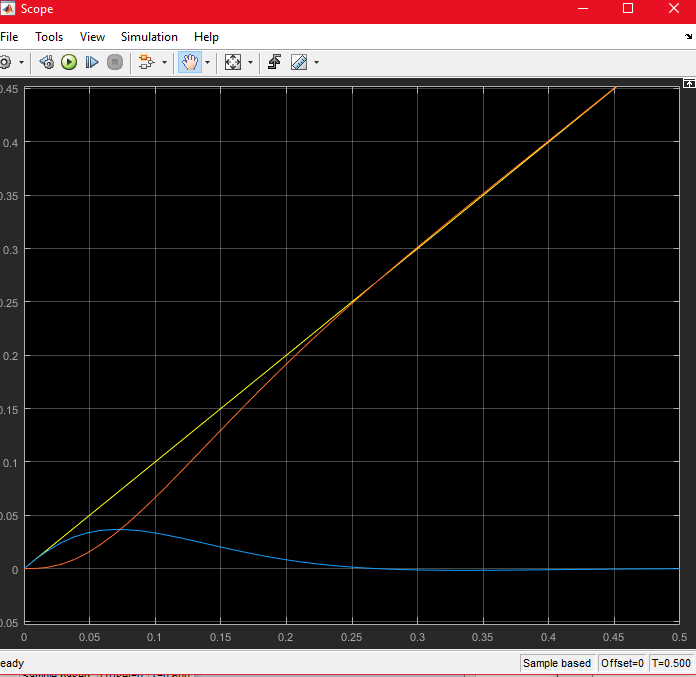


Figure Static Velocity Error. Yellow: Input, Orange: Output, Blue: Error



Figure Static Acceleration Error. Yellow: Input, Orange: Output, Blue: Error.