NANYANG TECHNOLOGICAL UNIVERSITY
School of Mechanical and Aerospace Engineering

EXPERIMENT E3.3: COMPUTER MODELLING, SIMULATION AND CONTROL OF AN ELECTROMECHANICAL SYSTEM

LOG SHEET

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Date:12/09/2025 Time:10.39 (AM / PM)

Submitted to:A-P Xie Ming

6.1 a): The open-loop system is unstable as the step-response does not stabilise into the 2% error range over time

6.1 b): The magnitude is -49.5 and the phase is -149

6.2 a):

Type of response	k	Mp	tp	ts	error (%)
Under damped	45	3.85%	3.6s	4.7s	2
Critically damped	23	n/a	n/a	6.56s	2
Over damped	17	n/a	n/a	9.85s	2

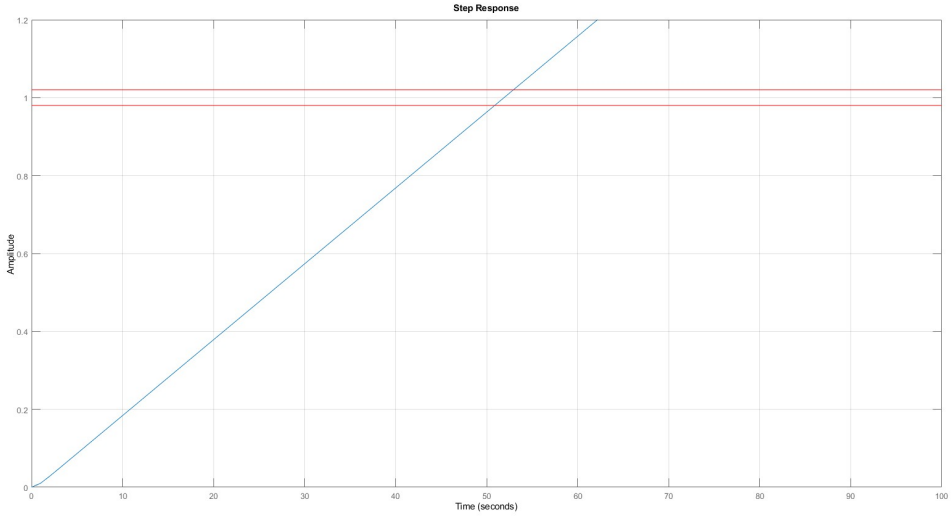
6.2 b): The peak value (mp) will increase, whereas the settling time (ts) decreases if k is increased.

7): No, the open loop for θm was not stable as the value did not stabilise into the 2% error range, but rather it overshot it and continued to increase. Yes, I was able to design a closed loop stable positional control system that met the desired specifications. This the k value used was able to create a response of peak value overshoot of 3.85% and settling time of below 10 seconds.

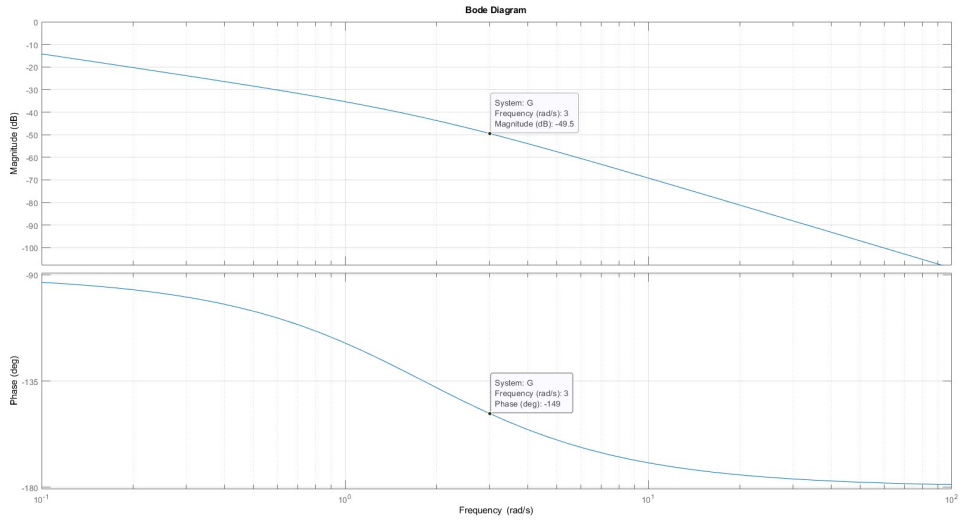
(Use additional pages, if needed)

Plots

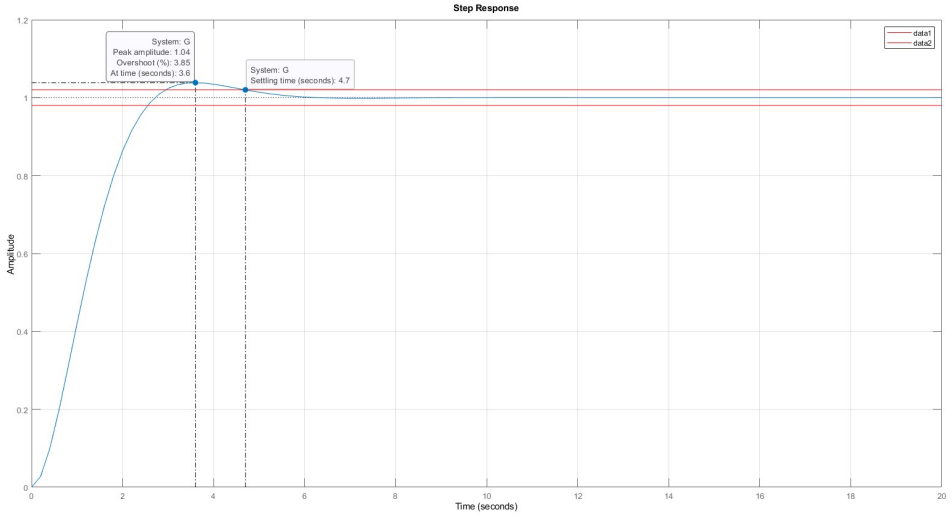
1. Open-loop step response



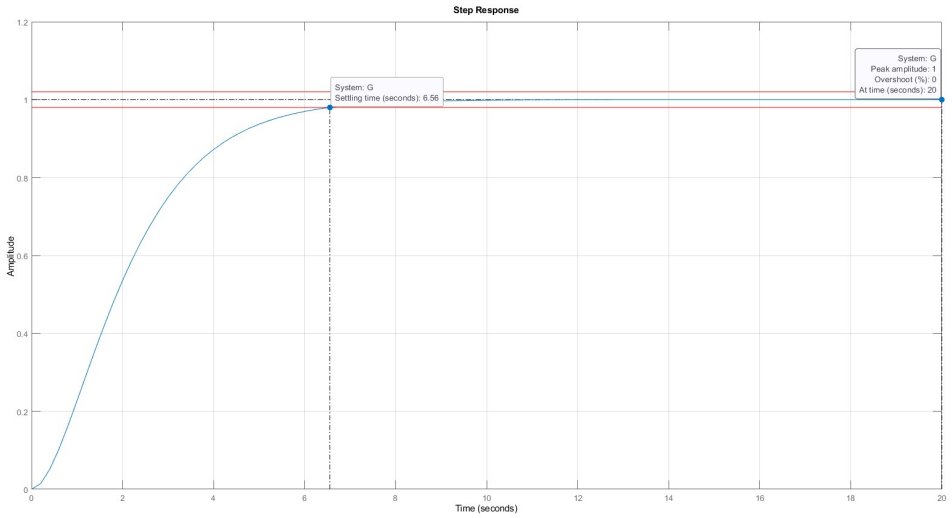
2. Open-loop Bode plot



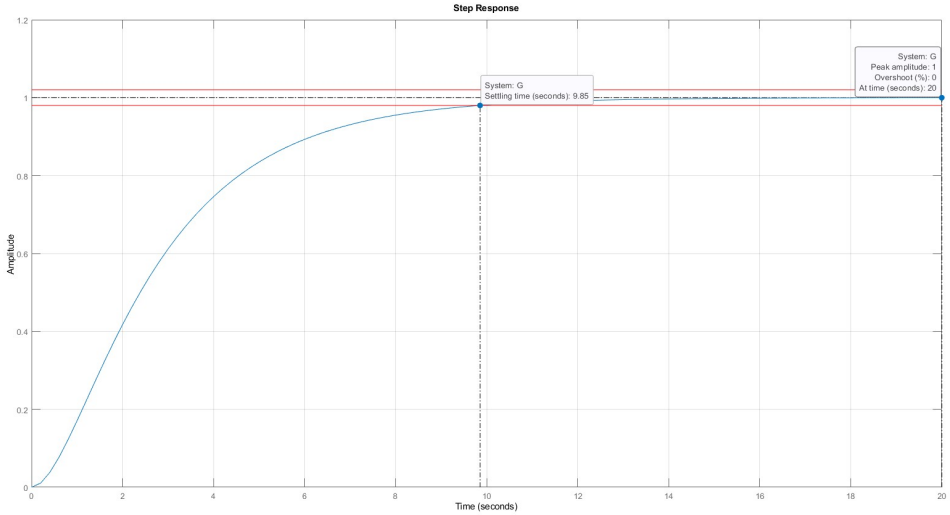
3. Closed-loop step response for underdamped condition



4. Closed-loop step response for critically damped condition



5. Closed-loop step response for overdamped condition


Step Response
System: G
Settling time (seconds): 9.85
System: G
Peak amplitude: 1
Overshoot (%): 0
At time (seconds): 20
Amplitude
Time (seconds)
0
0.2
0.4
0.6
0.8
1
1.2
0
2
4
6
8
10
12
14
16
18
20