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: 16/3/2023 Time: 9.30 (AM)

Submitted to: _____

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

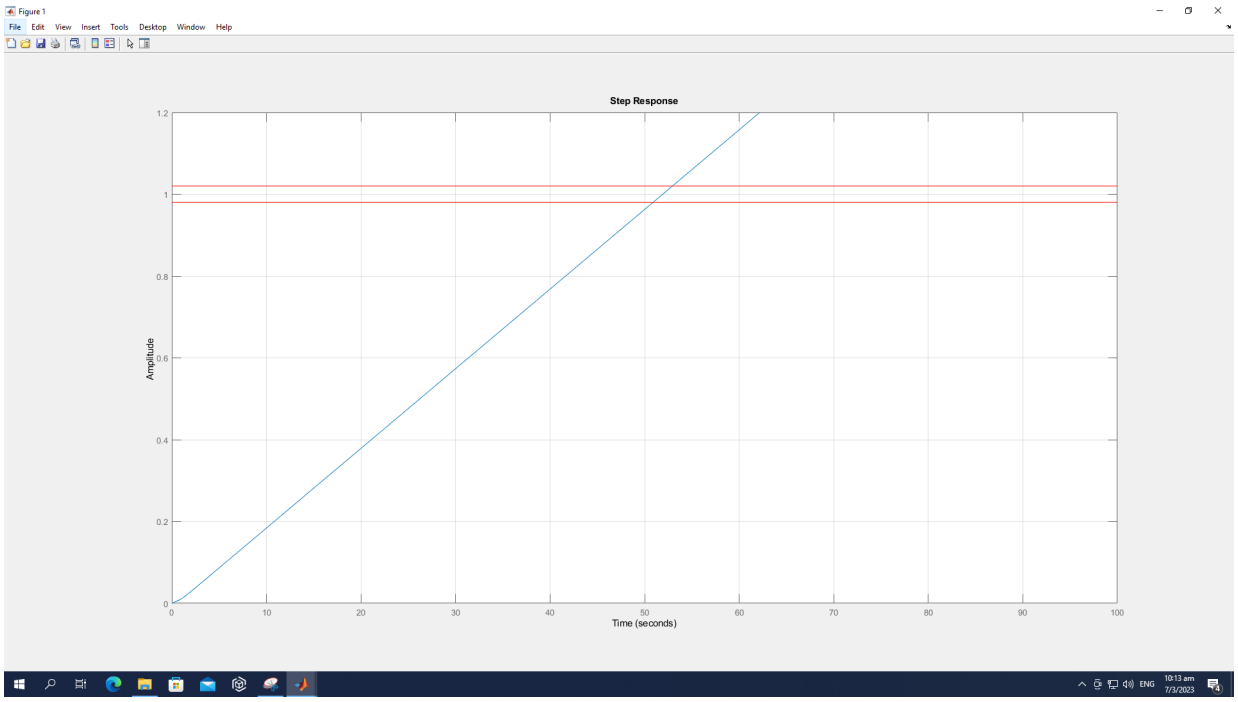
6.2 b): The peak value (mp) will increase, whereas the settling time (ts) decreases if k is increased.

7): No, the open loop for θ_m 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.

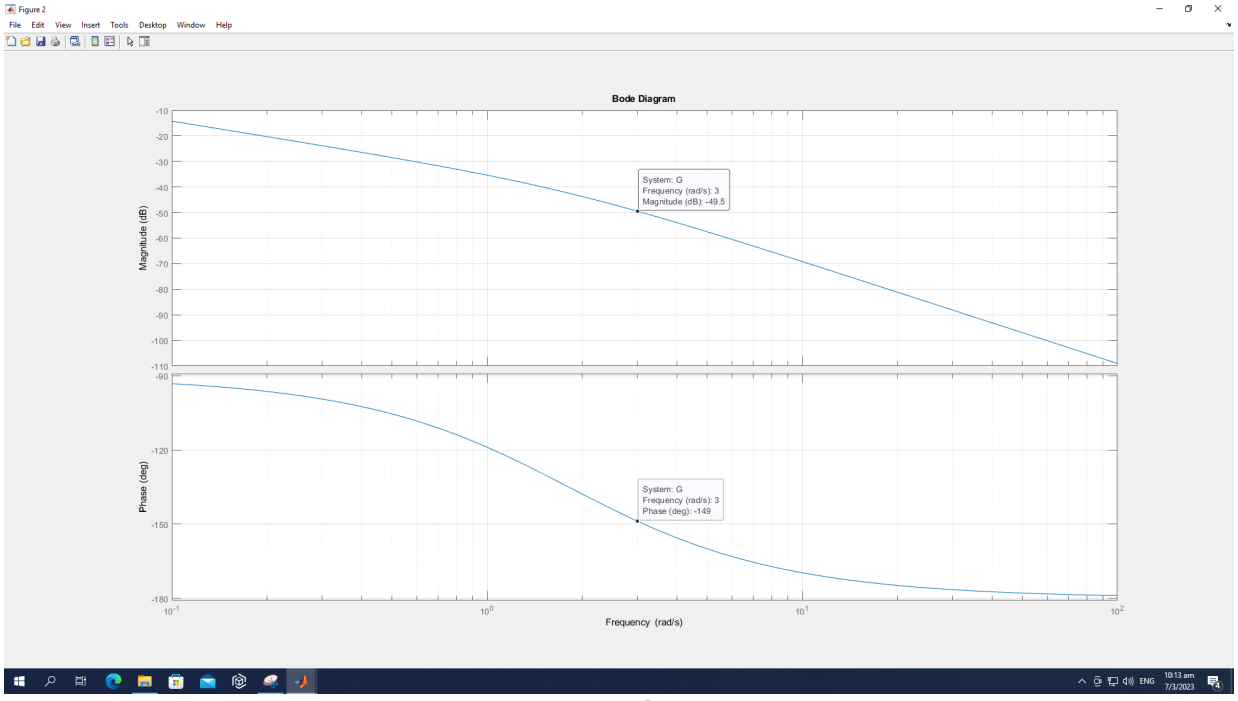
Plots

Using a screen capture tool (e.g. “Snipping Tool” in Windows), paste the plots related to:

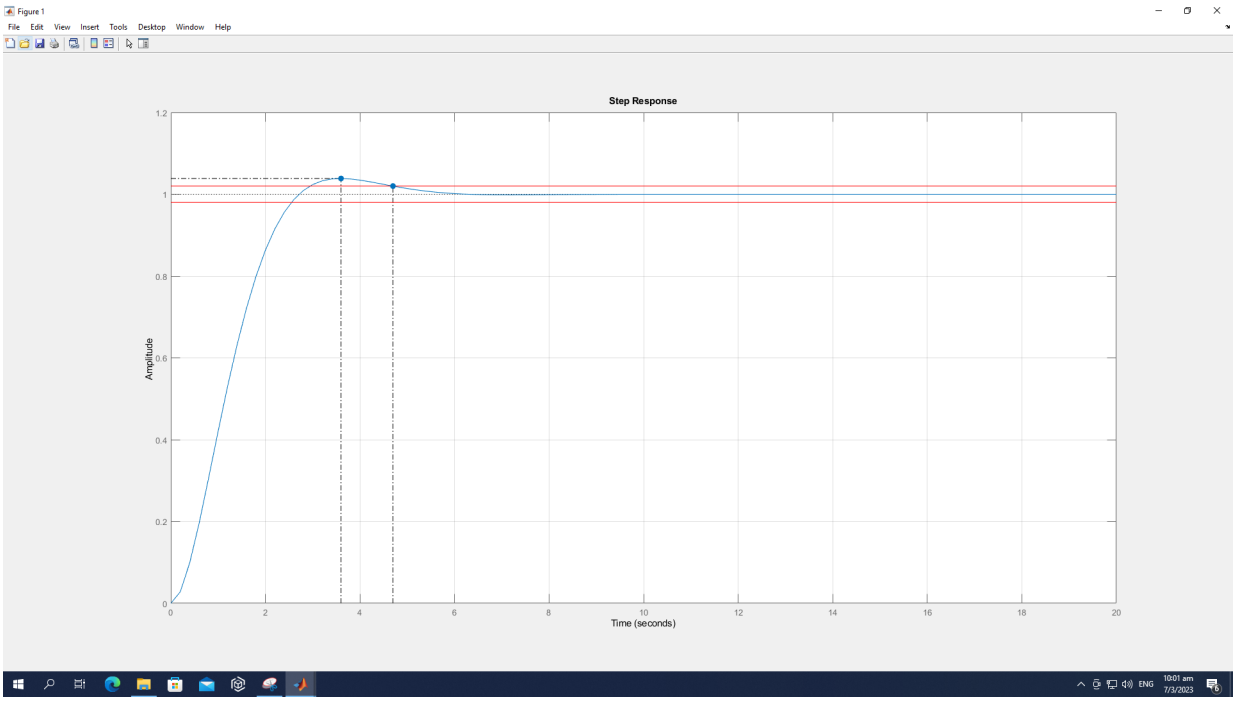
1. Open-loop step response
2. Open-loop Bode plot
3. Closed-loop step response for underdamped condition
4. Closed-loop step response for critically damped condition
5. Closed-loop step response for overdamped condition



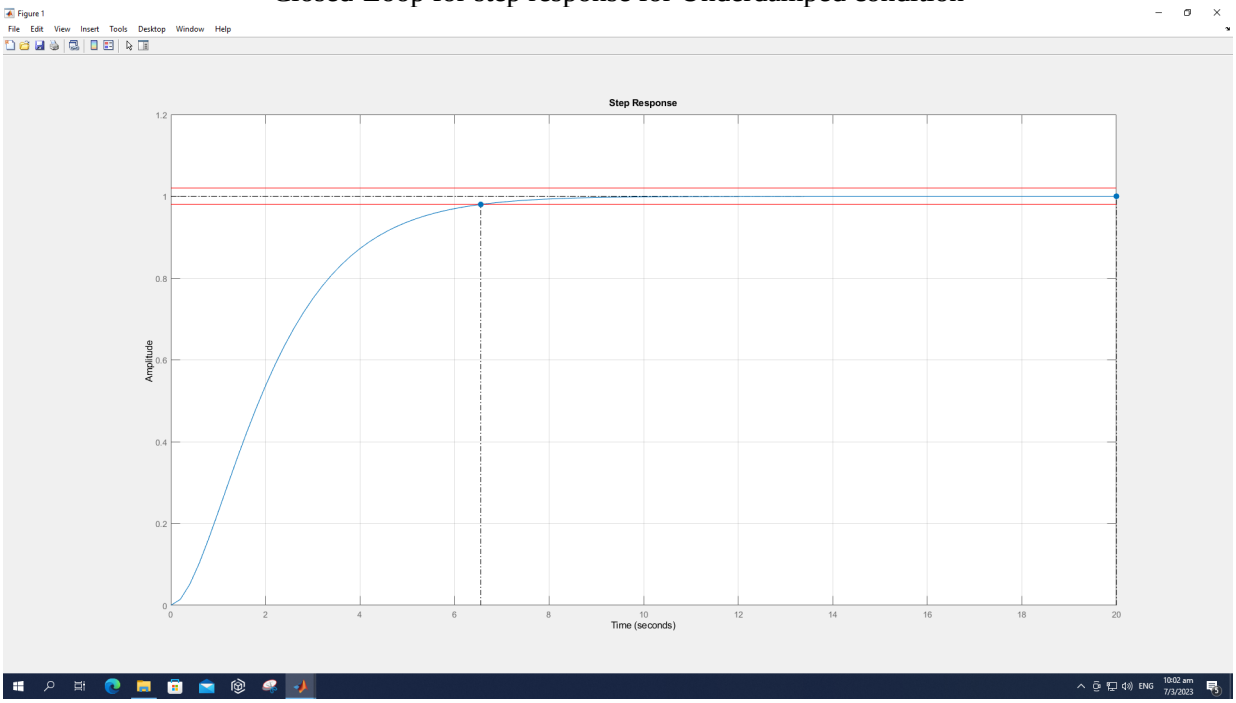
Open Loop Step Response



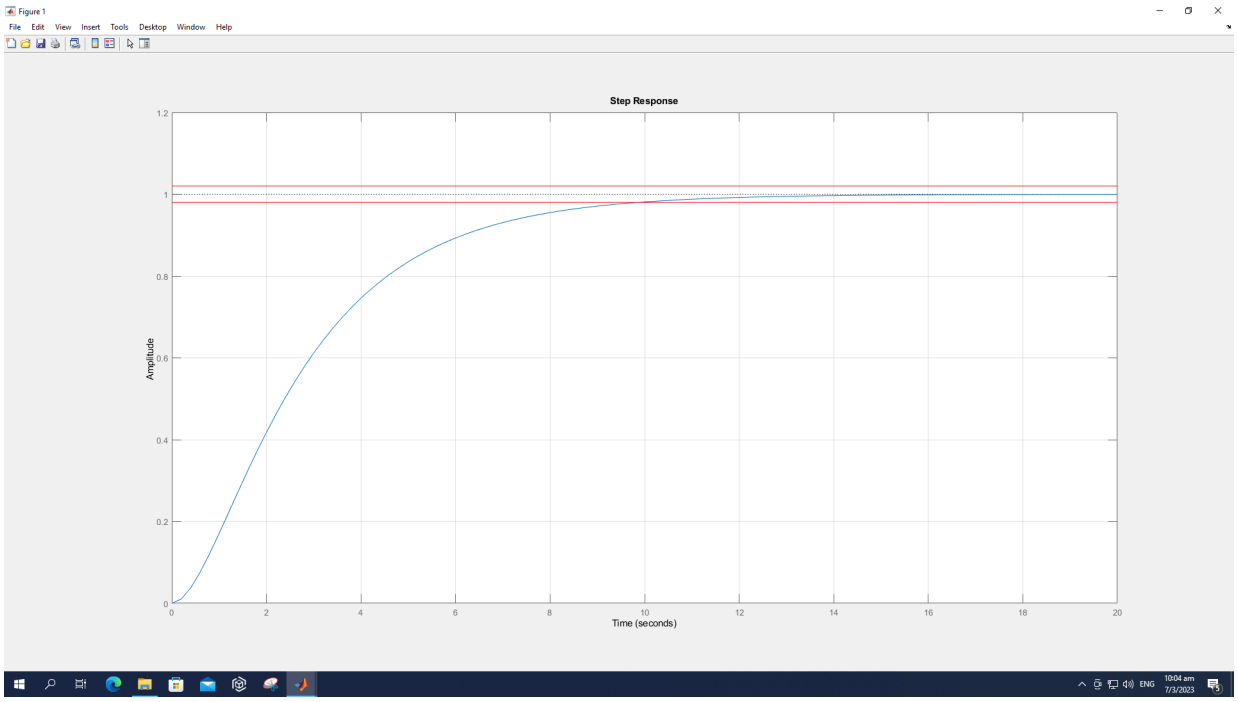
Open Loop Bode Diagram



Closed-Loop for step response for Underdamped condition



Closed-Loop for step response for Critically damped condition



Closed-Loop for step response for Overdamped condition