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 MARCH 2023 Time: 0930HR TO 1230HR (AM / ~~PM~~)

Submitted to: PROF XIE MING

6.1 Open Loop Response

(a) From the step-response graph obtained for the open-loop system, the amplitude does not stabilise into the 2% error range over time. Thus, the open-loop system is unstable.

(b) Magnitude: -49.5 dB

Phase: -149 degrees

6.2 Closed Loop Response

(a)

Type of response	k	Mp	tp	ts	error (%)
Under damped	47	4.43%	3.40	4.63	2
Critically damped	25	n/a	n/a	5.79	2
Over damped	17	n/a	n/a	9.85	2

(b) As k increases, the peak value (Mp) will increase while the settling time (ts) will decrease.

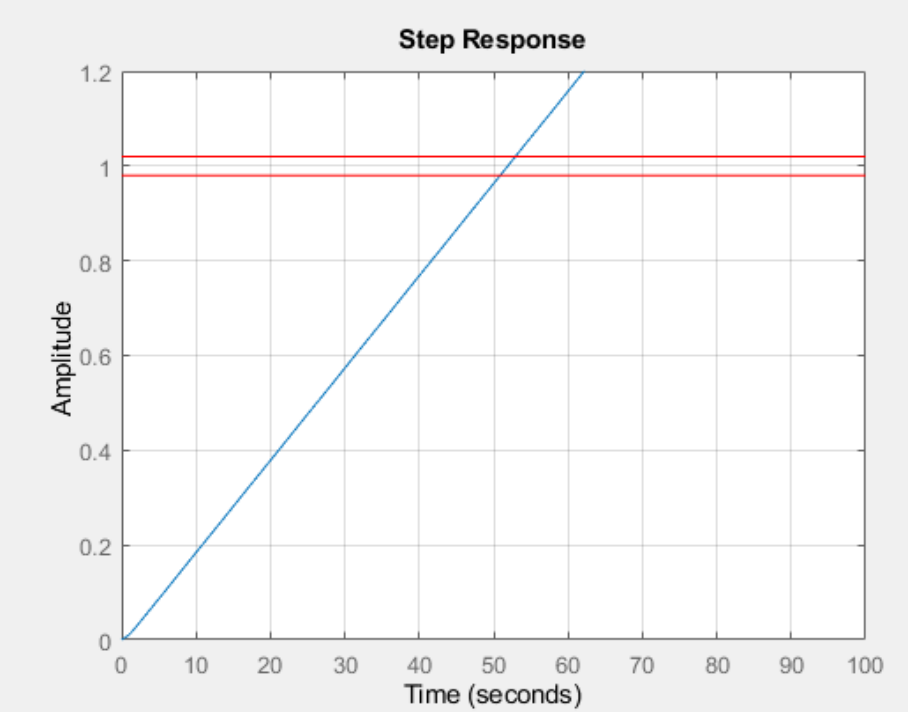
7 Conclusion

No, the open loop is not stable as the value did not stabilize into the 2% error range over time.

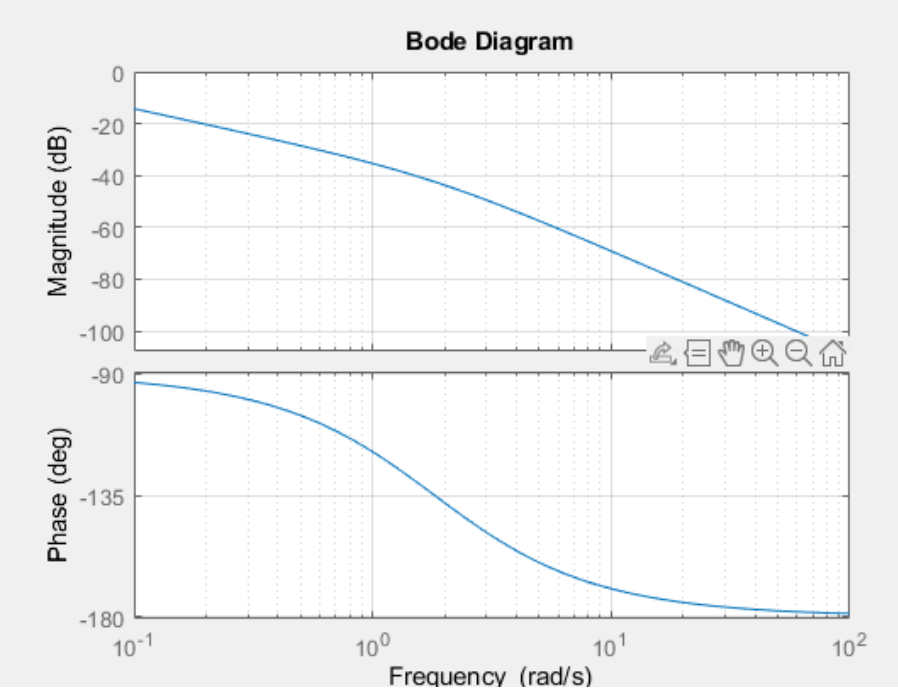
As for the closed loop, I was able to design a stable positional control system that met the desired specifications. The k value used (k = 47) was able to create a response within the desired specifications: peak value overshoot (Mp) = 4.43%, settling time (ts) = 4.63s, and error = ±2%.

8 Plots

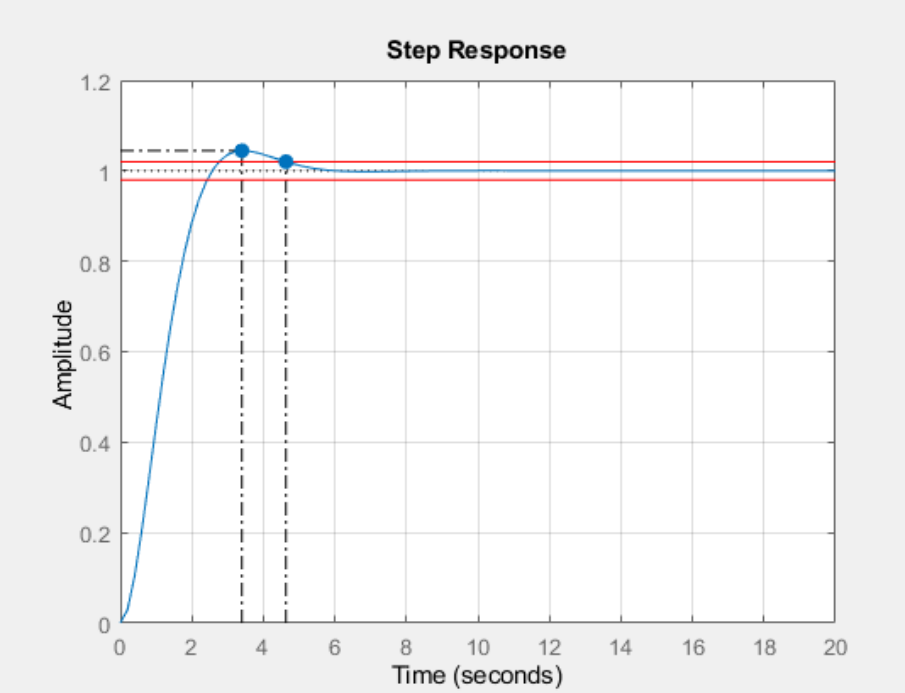
1. Open-loop step response



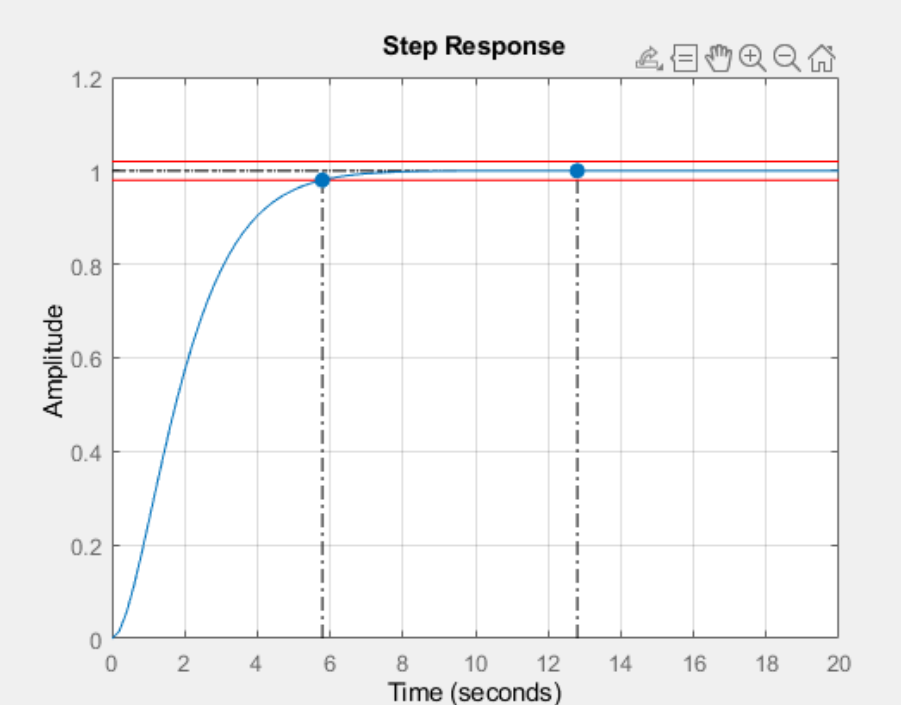
2. Open-loop Bode plot



3. Closed-loop step response for the underdamped condition



4. Closed-loop step response for the critically damped condition



5. Closed-loop step response for the overdamped condition