Electrical Engineering Department
Control systems

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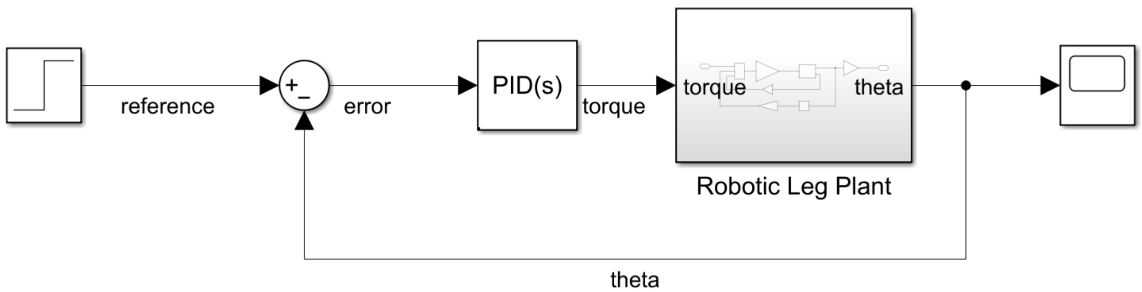
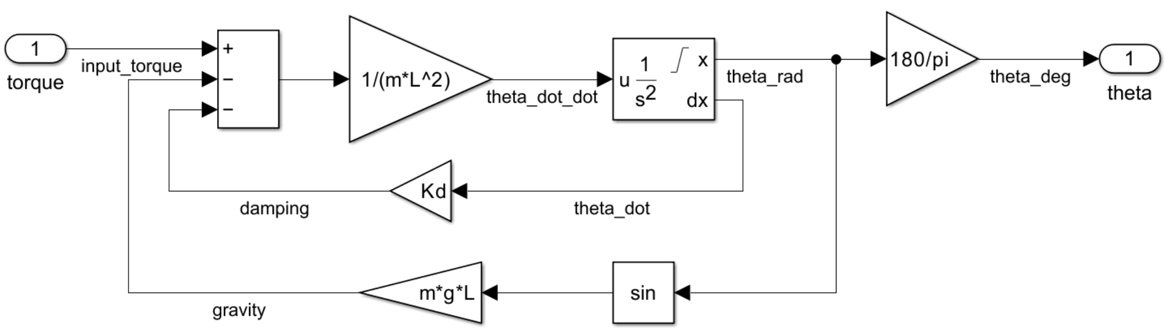
ID : 20010099

Section : 4

Task 1

Robotic Leg Modeling and Control

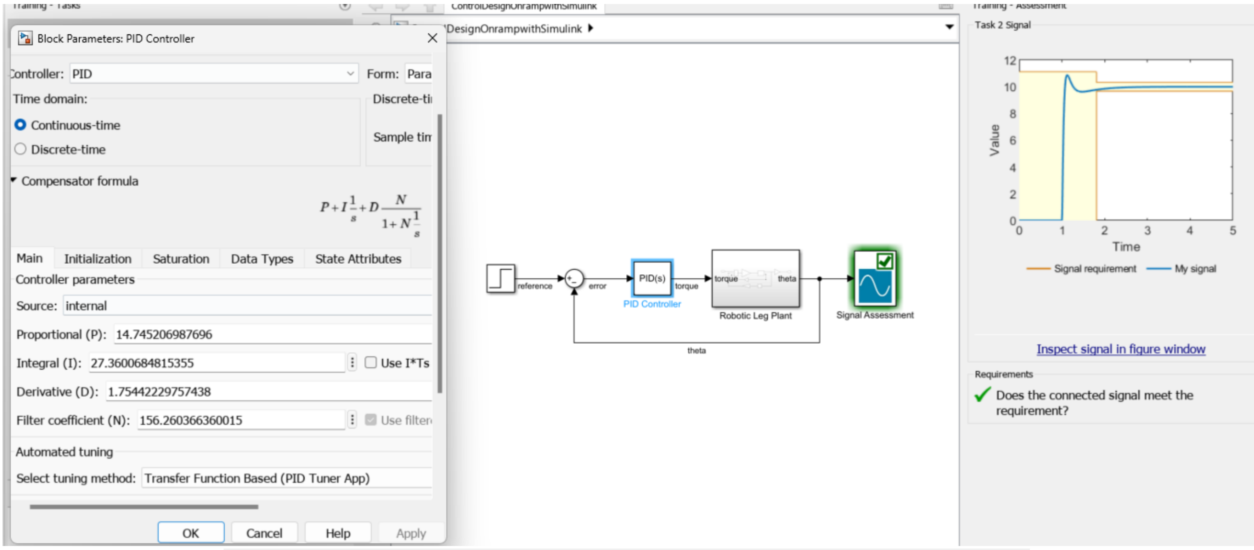


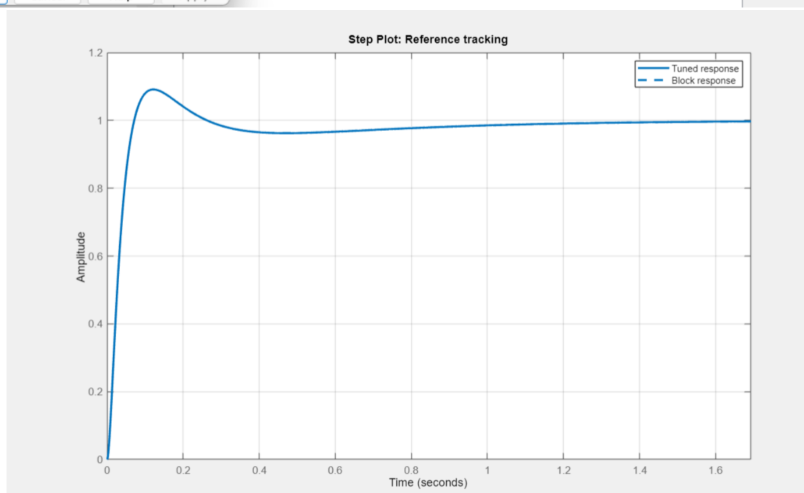


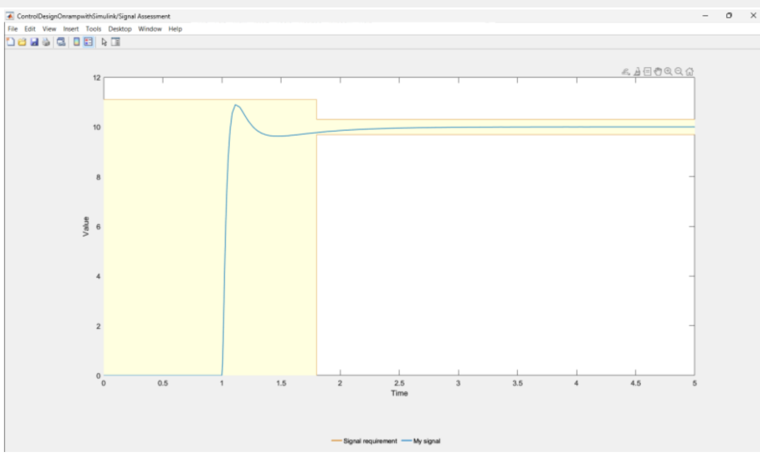
As :

- g = 9.8100
- Kd = 10
- L = 0.52
- m = 14

PID Tuning Parameters:







Requirements:

a. Certificate


MathWorks | Training Services

Course Completion Certificate

Ahmed Samy

has successfully completed **100%** of the self-paced training course

Control Design Onramp with Simulink

DIRECTOR, TRAINING SERVICES

13 December 2023

b. Web view for Simulink Model [Link]

Task 2

DC motor control

Part I: Position control

- System Equations

$$V_1 = -R_3\left(\frac{V(\theta i)}{R_1} + \frac{-V(\theta o)}{R_2}\right)$$

$$V_2 = -V_1\left(\frac{R_5}{R_4}\right)$$

$$I_a = \left(\frac{V_2 - E}{sL_a + R_a}\right)$$

$$w = \left(\frac{T}{sJ_{eq} + B_{eq}}\right)$$

$$V_T = K \times w$$

$$-V(\theta o) = V_T \frac{-1}{sR_6C_1}$$

$$V(\theta o) = -V(\theta o)\frac{R_8}{R_7}$$

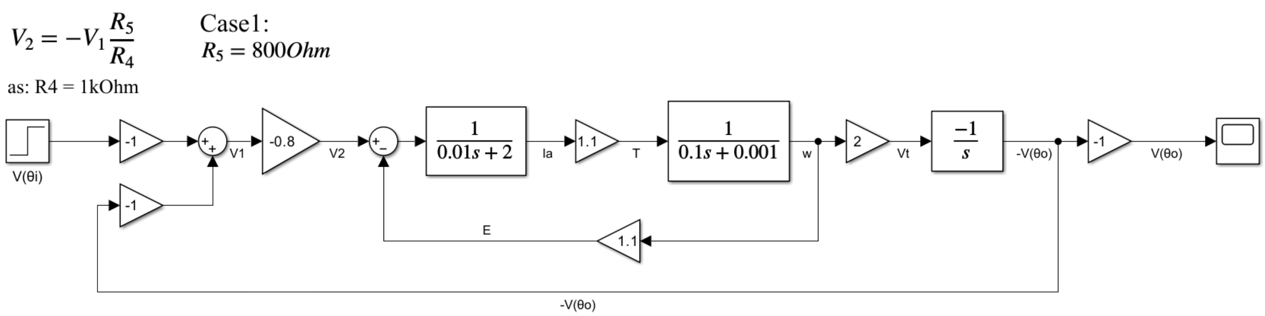
From Givens:

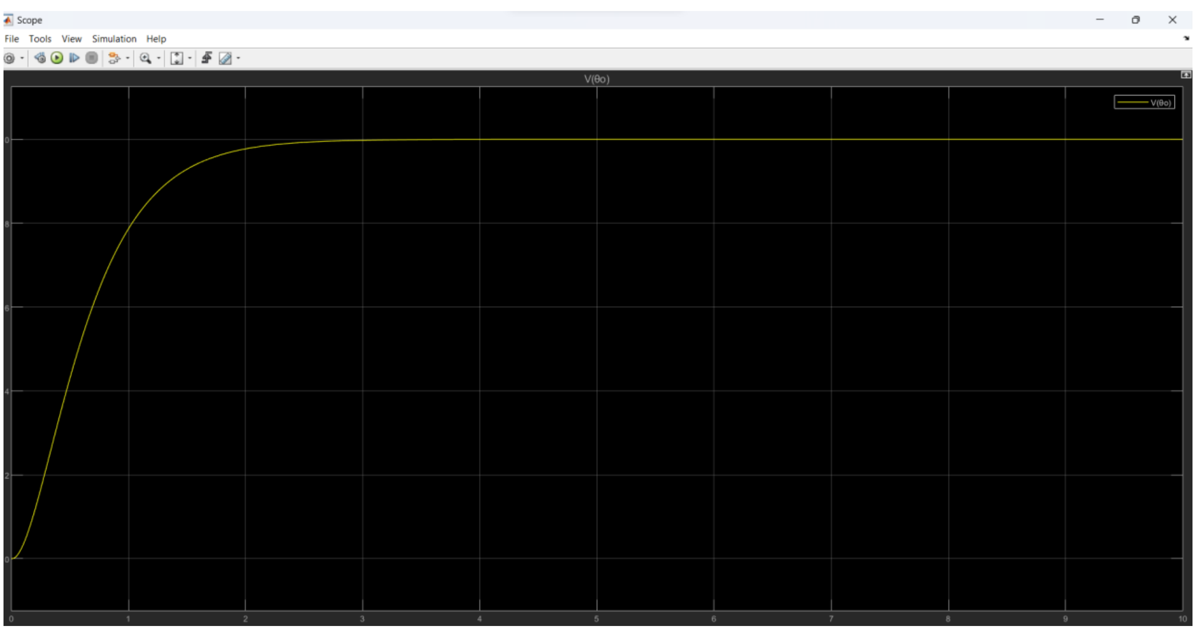
- R1=R2=R3=R7=R8=1 kΩ
- R4=1 kΩ
- La=10 mH & Ra=2 Ω. (DC motor equivalent inductance and resistance)
- Km=Kb=1.1 (DC motor constants)
- Jeq=0.1 & Beq=0.001 (equivalent inertia and friction of the system)
- Kt=2 (tacho-meter constant)
- R6=100 kΩ & C1=10 µF

- V(θi)= 10 u(t).

Case (1):

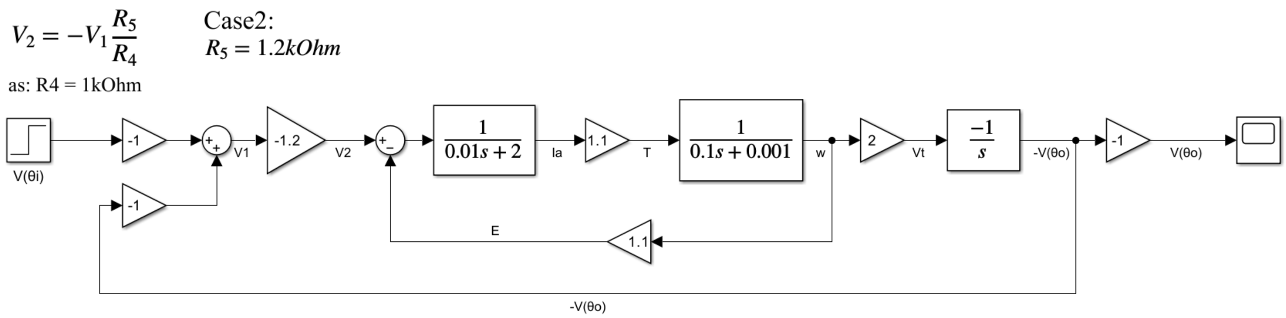
- System is Over Damped

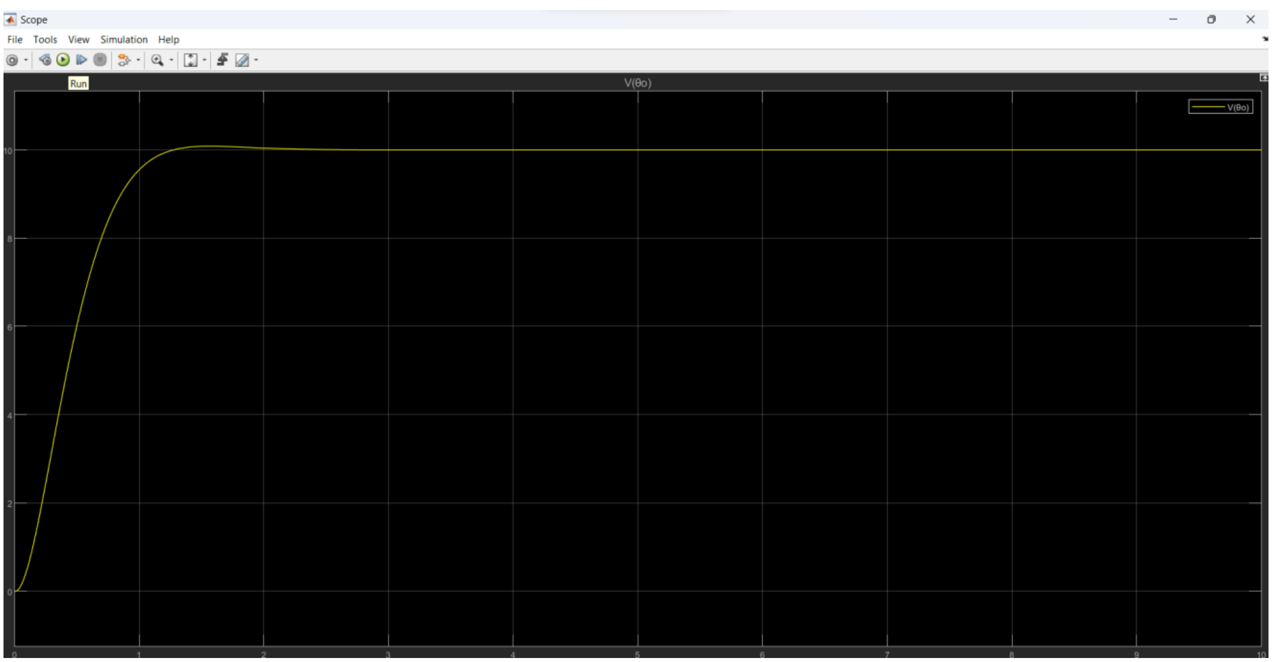




Case (2):

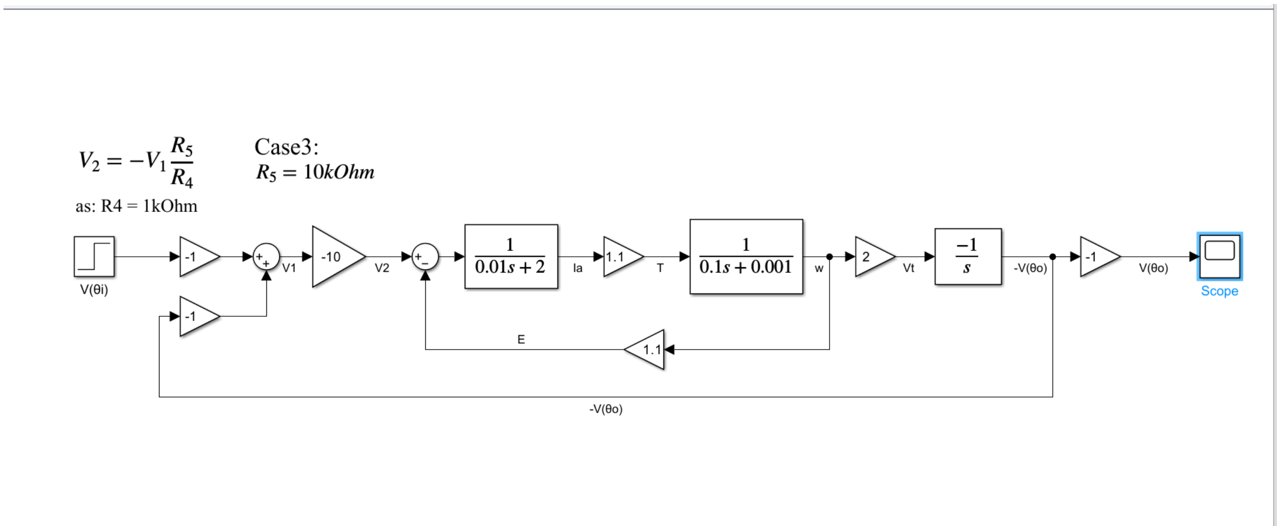
- System is Critically Damped

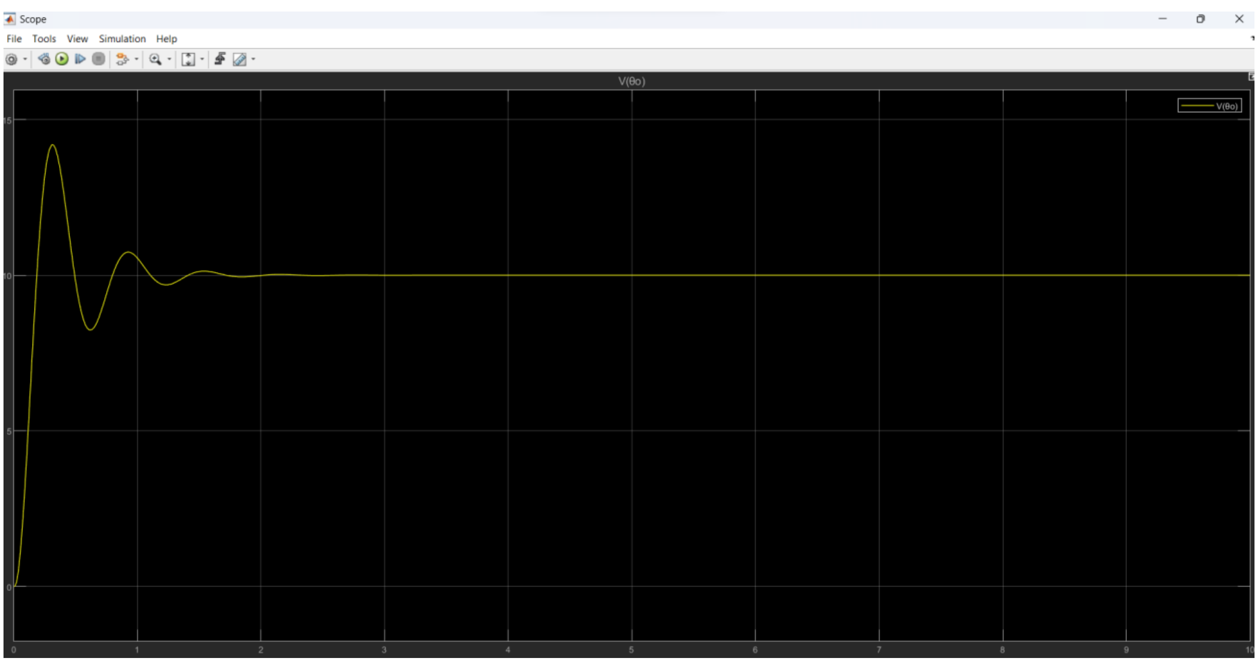




Case (3):

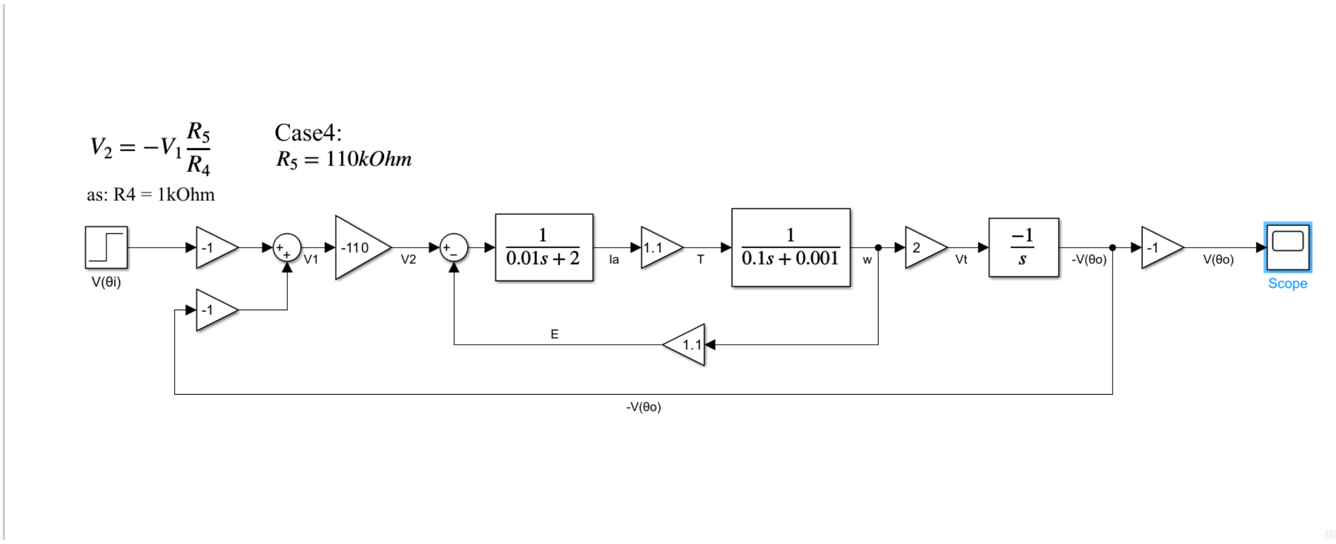
- System is Under Damped

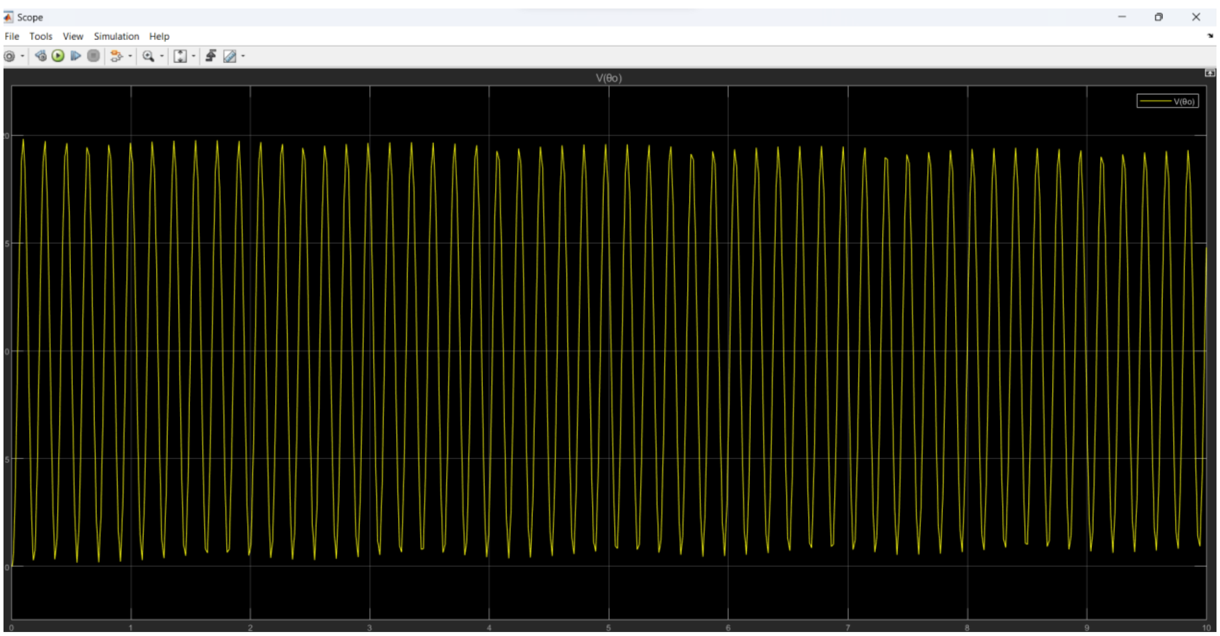




Case (4):

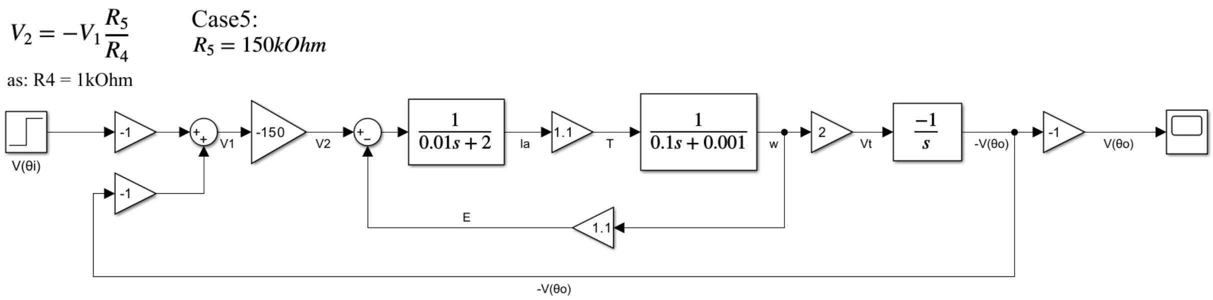
- System is Unstable

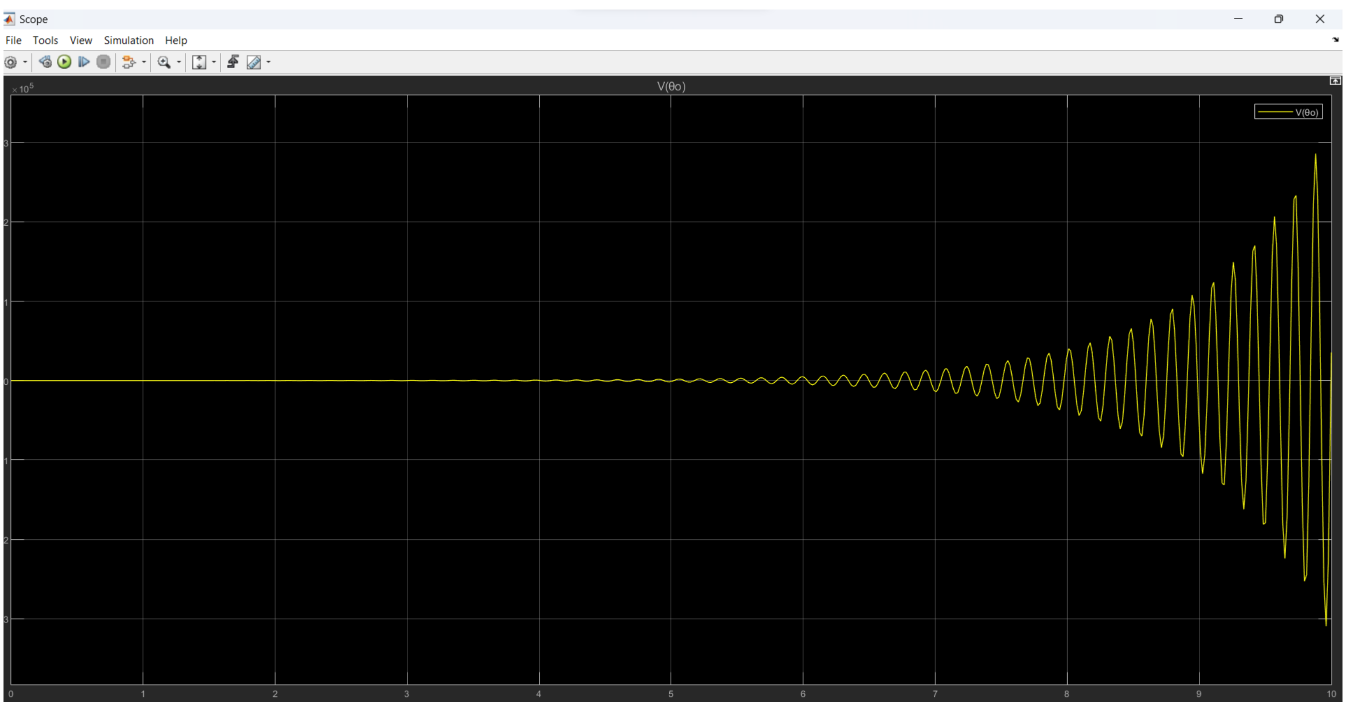




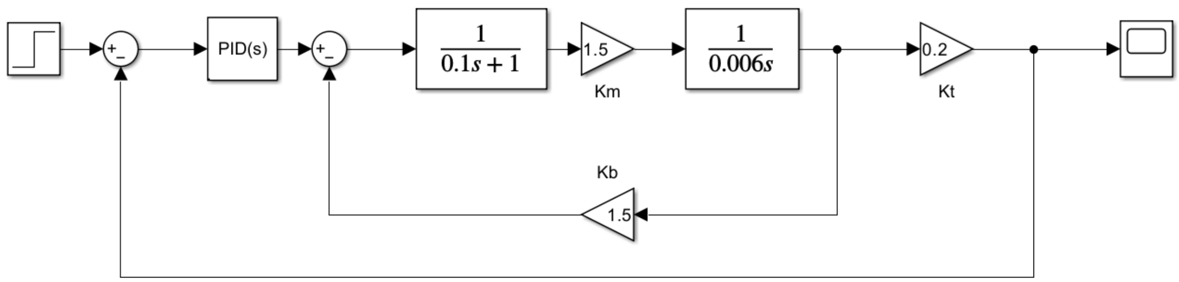
Case (5):

- System is Oscillate



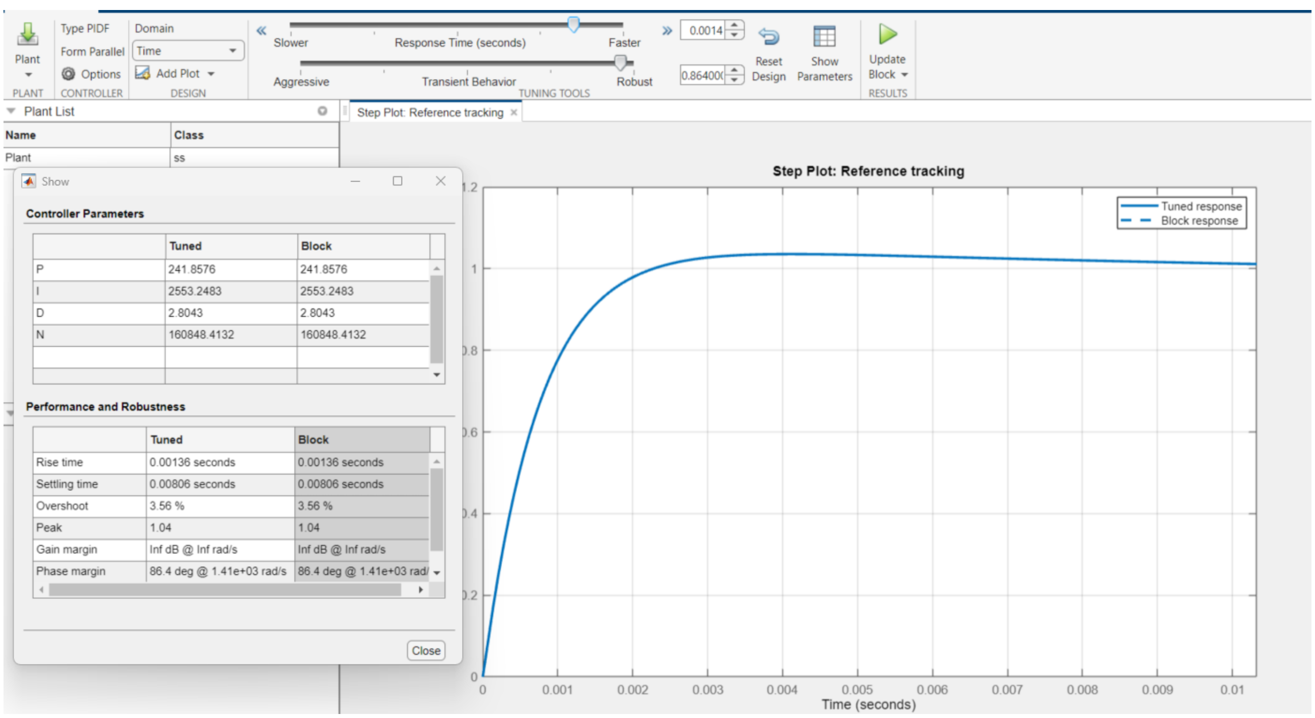


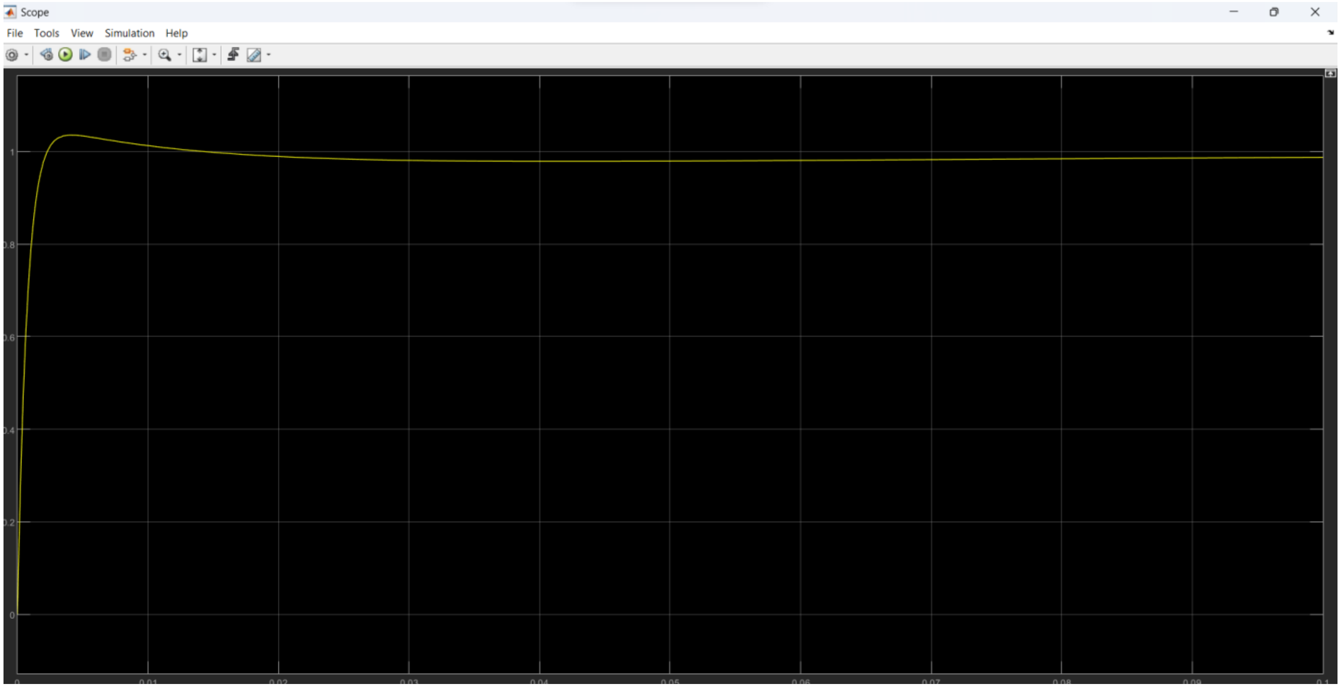
Part II: Speed control



Requirements:

- Zero steady state error.
- Maximum overshoot less than 5%.
- Settling time less than 10 ms.
- Rising time less than 5 ms



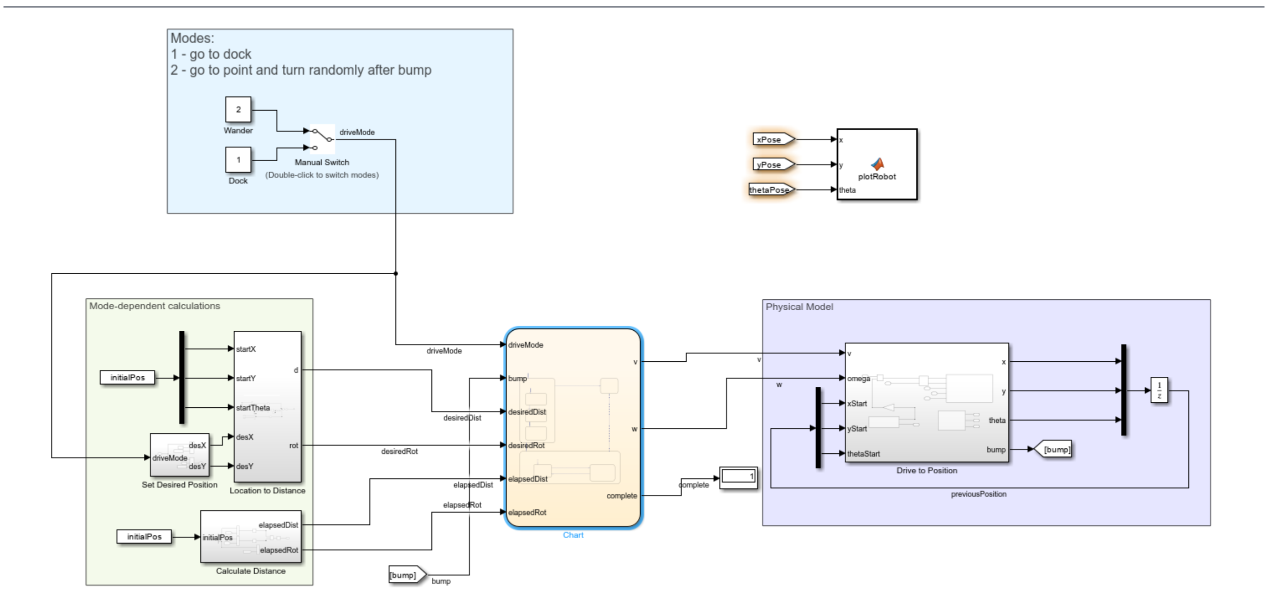


- Web view for Simulink Model [Link]

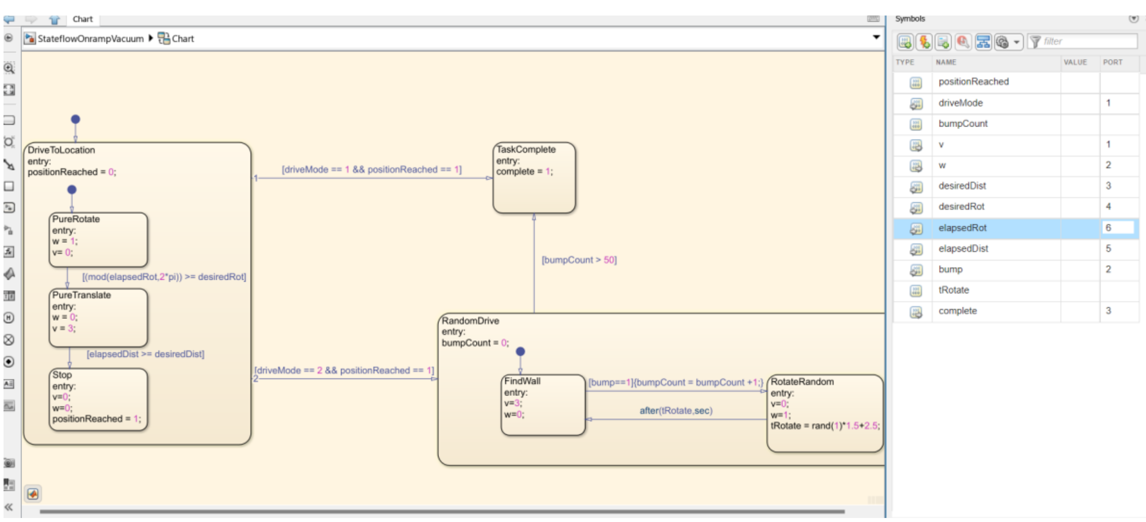
Task 3

Robot Vacuum Driving Modes

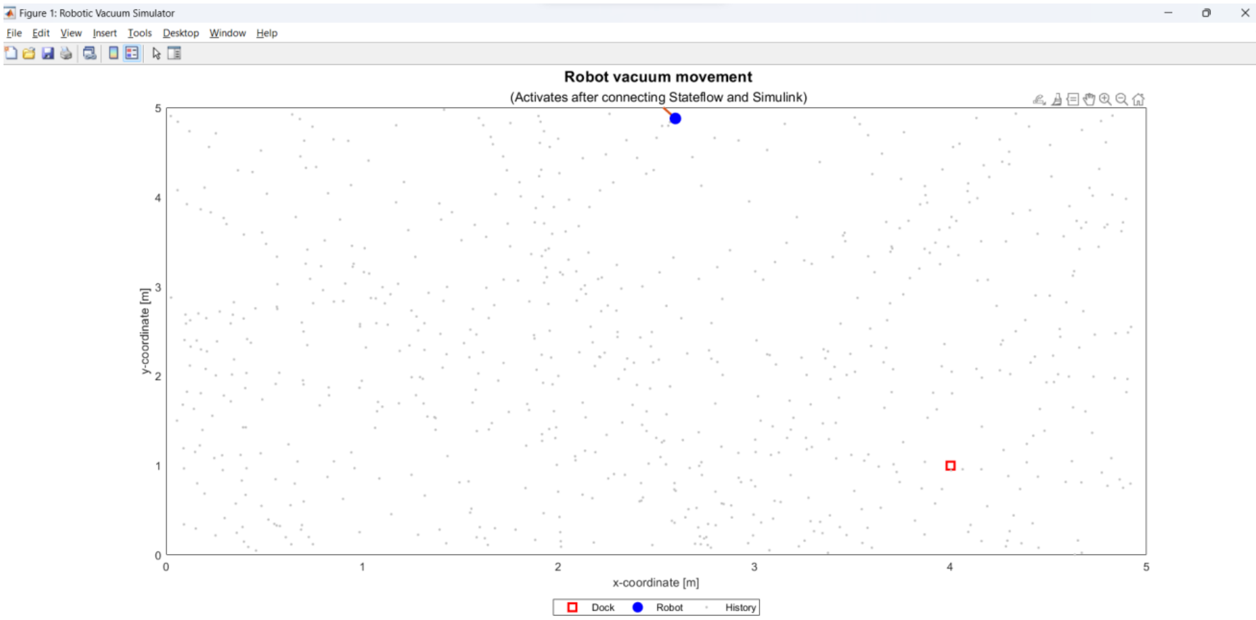
- High level architecture



- Implementation details



- Output Simulation



Requirements:

c. Certificate

d. Web view for the Model [Link]