YILDIZ TECHNICAL UNIVERSITY

FACULTY OF ELECTRICAL & ELECTRONICS ENGINEERING

DEPARTMENT OF CONTROL AND AUTOMATION ENGINEERING

KOM4221

CONTROL LABORATORY

Experiment 11

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Summary of Experiment

The aim of this experiment is to design a PIV controller in order to obtain desired requirement for the Payload Position control.

Theory Implementation and Numerical Calculations

Question 2)

Desired %OS=11, so ζ value should be equal to 0.575 and for desired peak time=0.01, ω_o obtained as 383.986. Also, pole location is p_0=0.111.

```
11 -    zeta=0.575;
12 -    w_o=383.986;
13 -    p_o=0.111;
14 -    kp=w_o*(2*zeta*p_o*J_phi+w_o*mp*r_y_reel^2+w_o*J_phi+2*zeta*p_o*mp*r_y_reel^2)/(r_y_reel*eff_y_t*Kg_y*eff_m_y*Kt_y);
15 -    ki=(w_o^2*p_o*(mp*r_y_reel^2+J_phi))/(r_y_reel*eff_y_t*Kg_y*eff_m_y*Kt_y);
16 -    kv=(p_o*J_phi+2*zeta*w_o*mp*r_y_reel^2+2*zeta*w_o*J_phi+p_o*mp*r_y_reel^2)/(r_y_reel*eff_g_y*Kg_y*eff_m_y*Kt_y);
```

Figure 1: Calculations for Gain Values

According to these formula, related gains calculated as follows

$$K_p = 488.73, K_i = 54.23, K_v = 1.4636$$
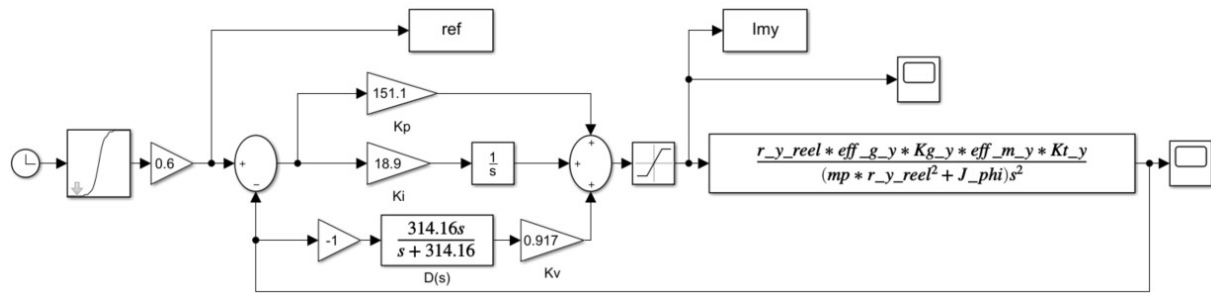
Simulation Studies

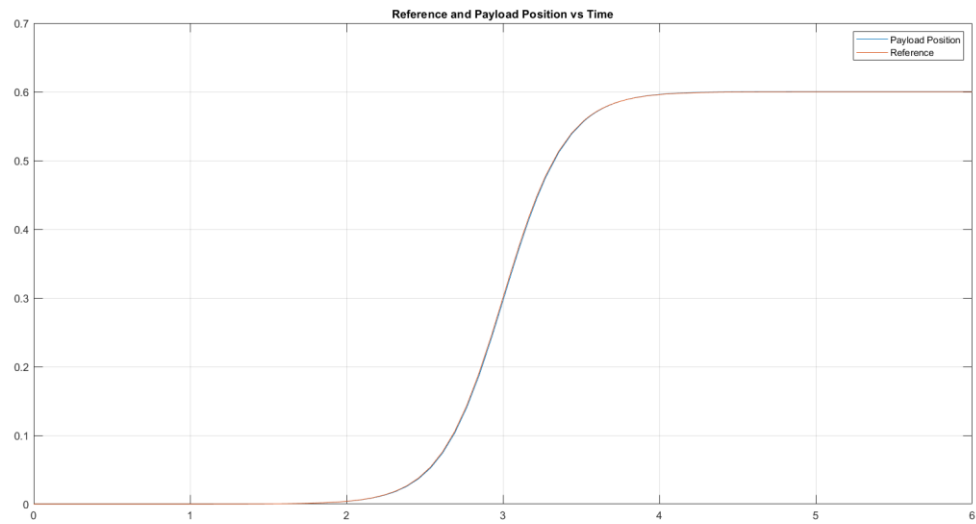### Question 1)

Figure 2: Block Diagram of System

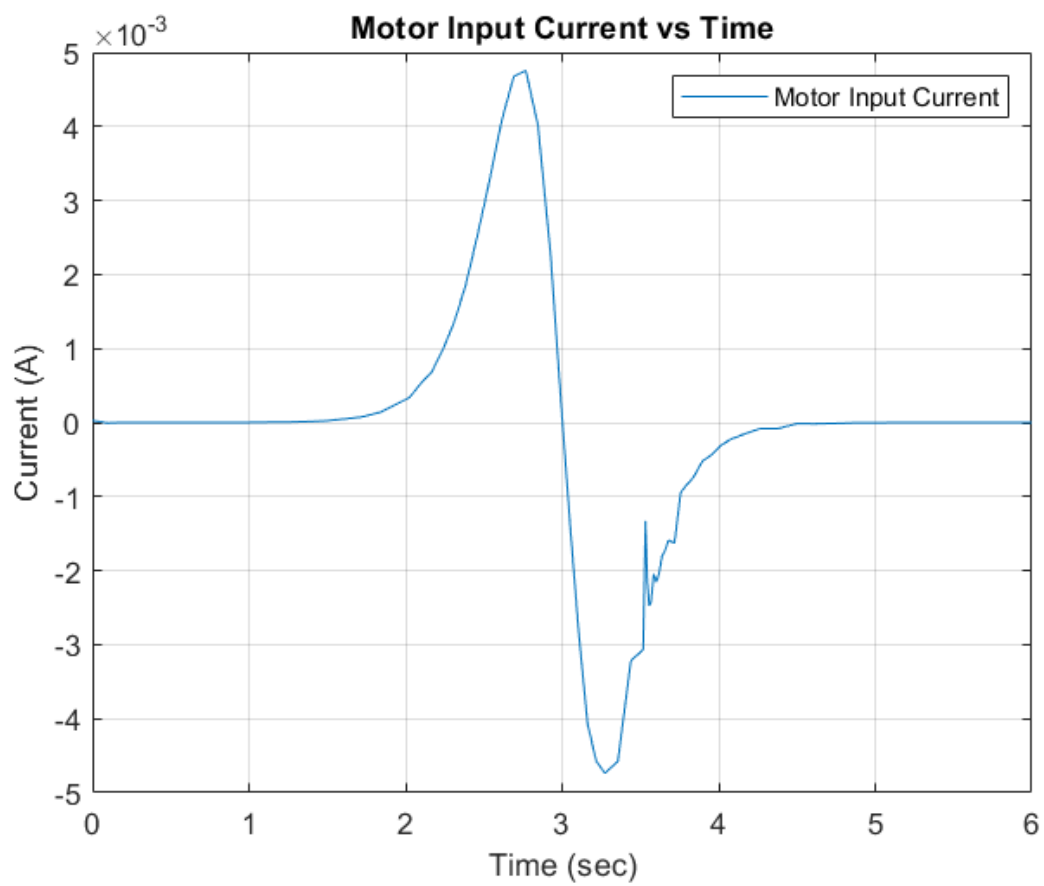Figure 3: Reference and Actual Position vs Time

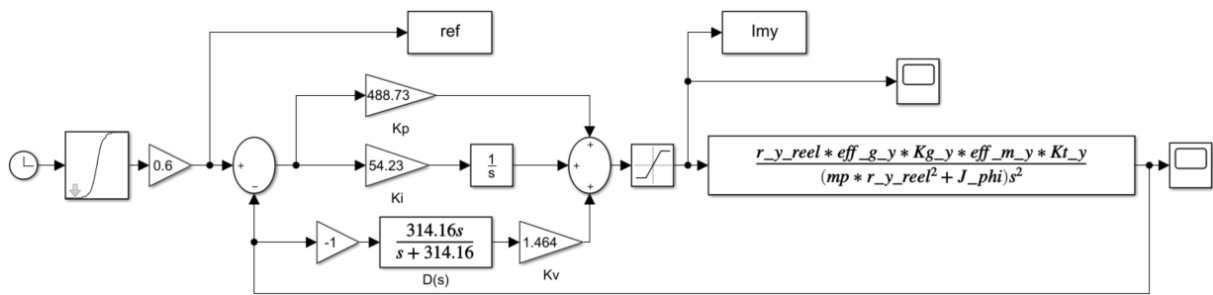Figure 4: Motor Current vs Time

Question 2)

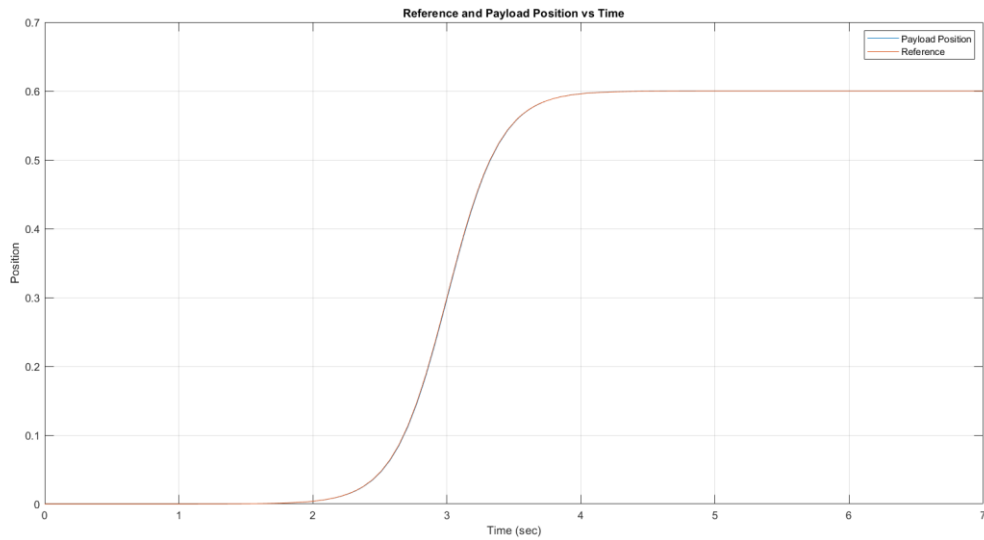Figure 5: Block Diagram of System for Calculated Gains

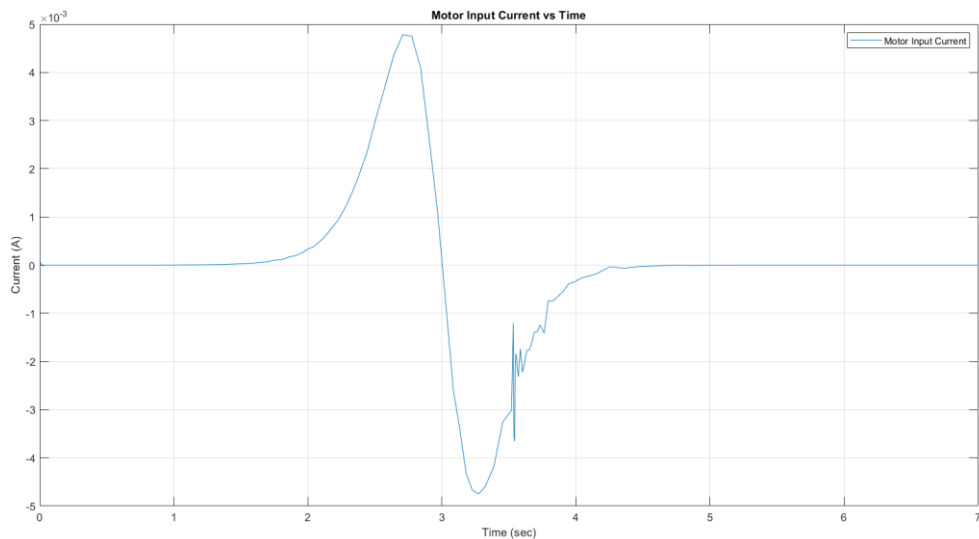Figure 6: Reference and Actual Position vs Time for Calculated Gains

Figure 7: Motor Current vs Time for Calculated Gains

Analysis and Interpretation of Results

Question 1)

As can be seen from figure 3, percent overshoot criterion satisfied. It is hard to confirm peak time criterion such a reference value, but we can say that it is really close to desired. Also, from figure 4, system gives more current to motor in advance and after that it goes vice versa.

Question 2)

We can see from figure 5, actual position of payload is almost same as reference signal and we can conclude that percent overshoot criterion is met. Moreover, peak time of system is too small. From figure 6, we can say that system gives current to motor in high level beforehand, after that it goes negative values to balance.