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FACULTY OF ELECTRICAL & ELECTRONICS ENGINEERING
DEPARTMENT OF CONTROL AND AUTOMATION ENGINEERING

KOM4221
CONTROL LABORATORY
Experiment 4

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Summary of Experiment

The aim of this experiment is to design a PD controller to meet the required specifications.

Simulation Studies

Question 1)

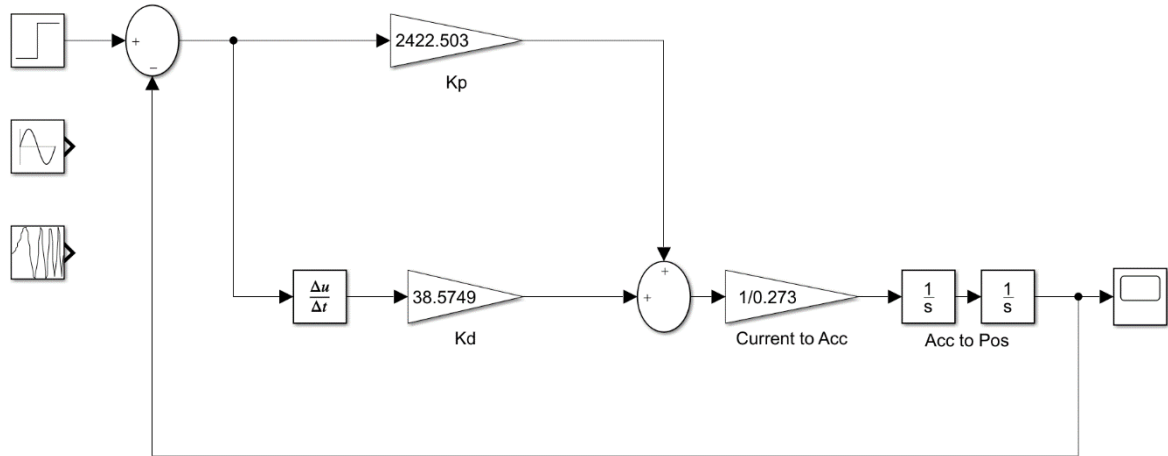


Figure 1: Model of System

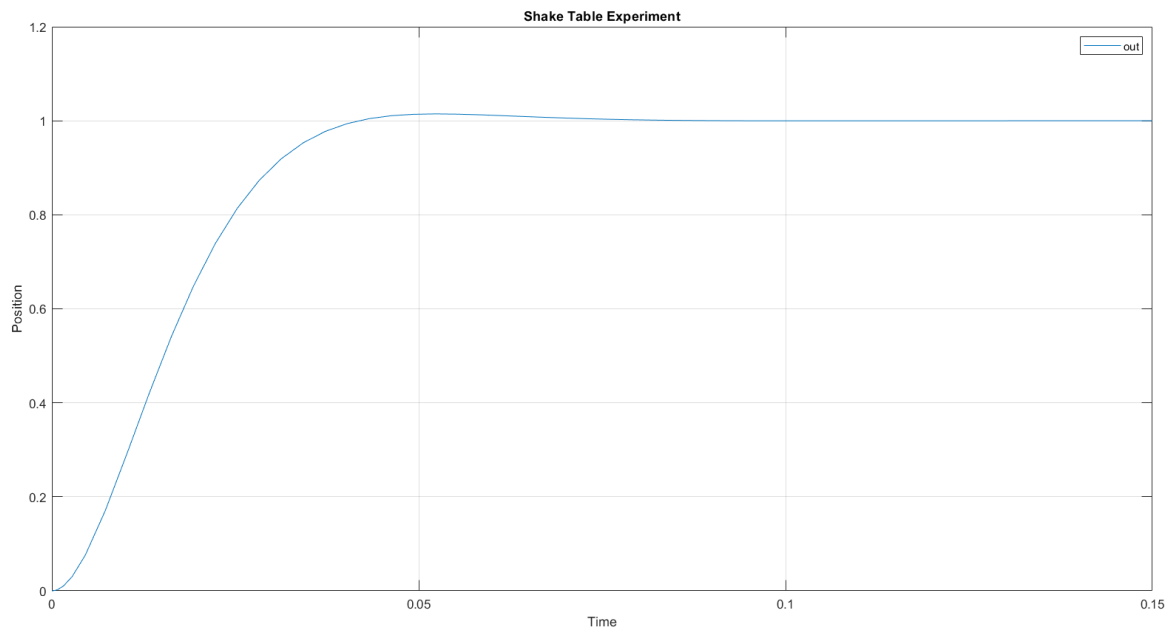


Figure 2: Response of System with -1 Sampling Time

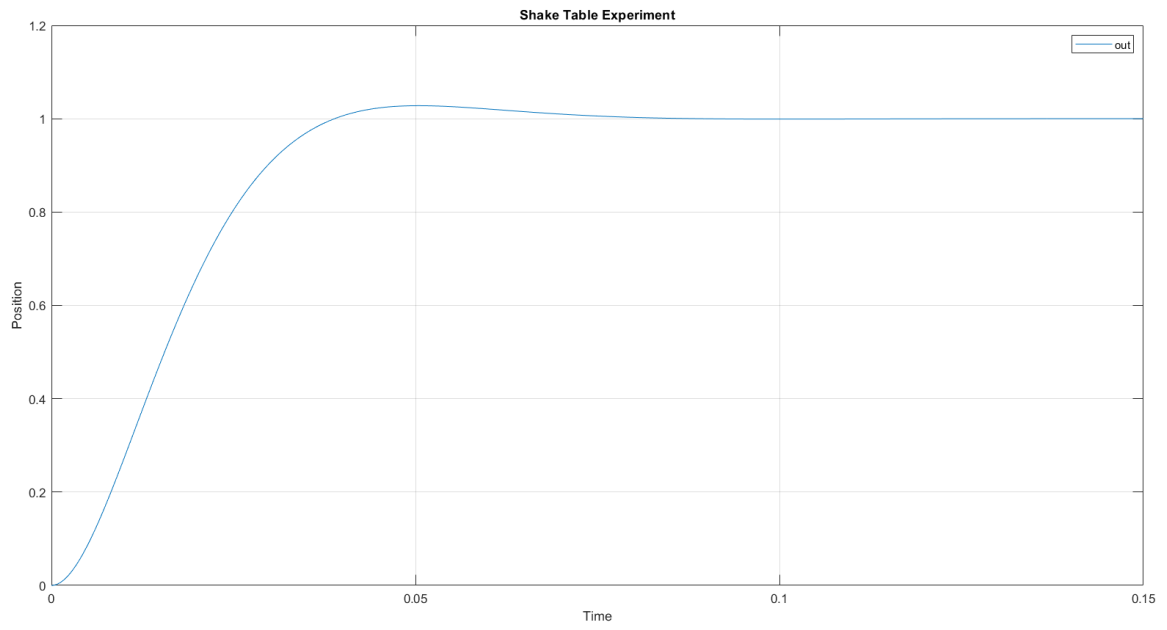


Figure 3: Response of System with 0.0001 Sampling Time

Question 2)

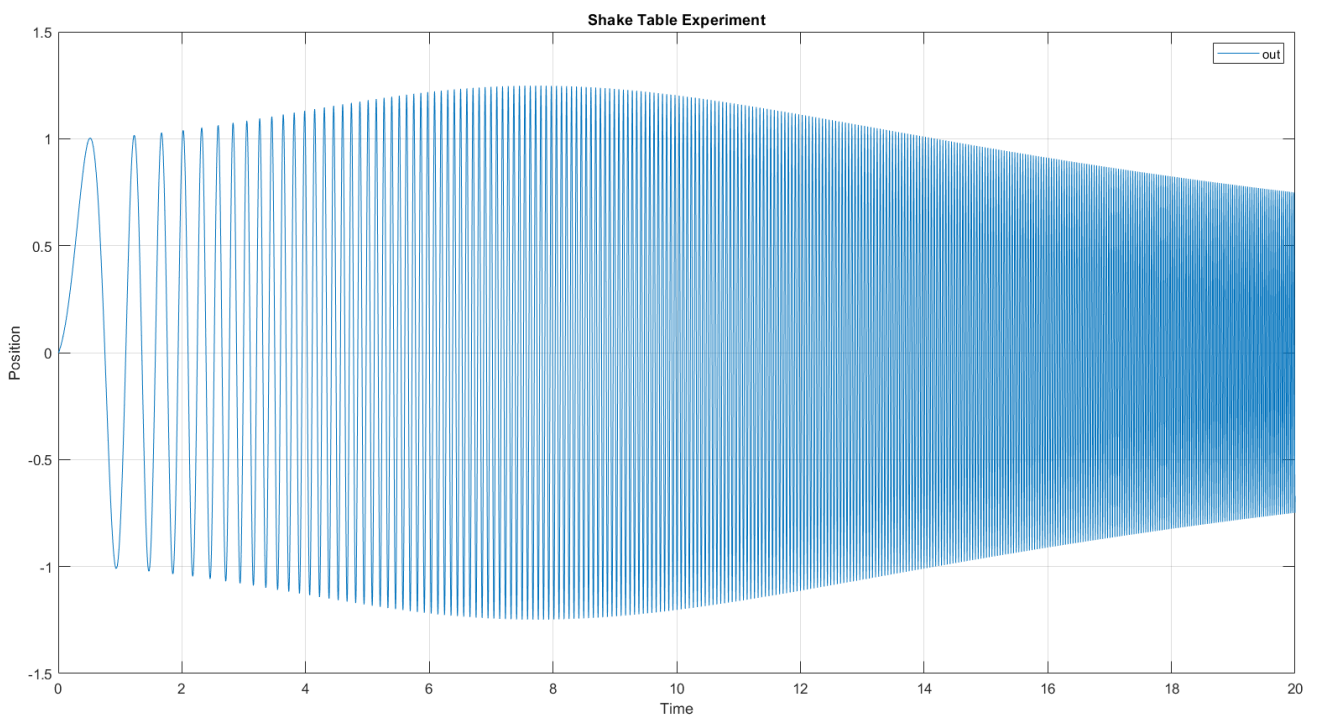


Figure 4: Response of System for Chirp Signal

Question 3)

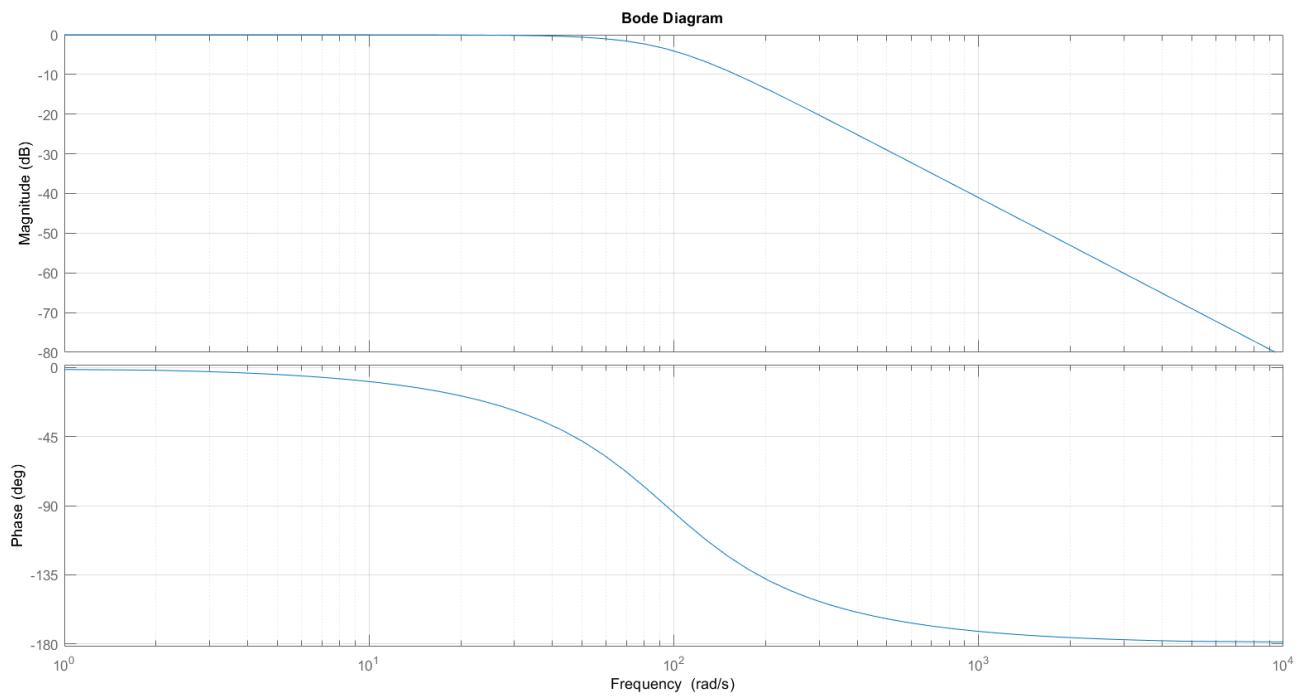


Figure 5: Bode Plot of Closed Loop System

Question 4)

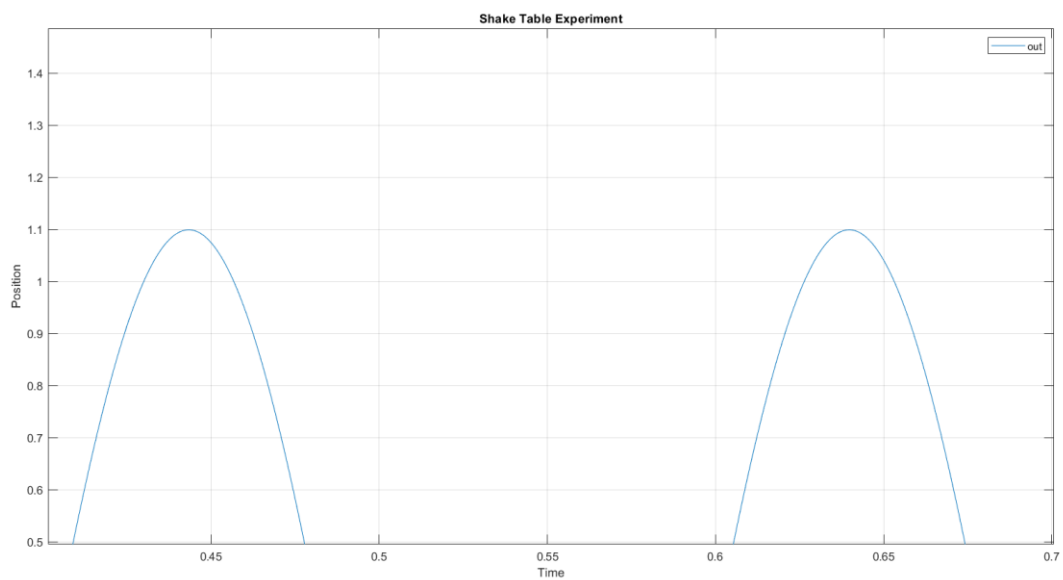


Figure 6: Response of System for 32Hz Sine

Analysis and Interpretation of Results

Question 1)

Using max function in MATLAB %OS calculated as 1.46% and peak time calculated as 0.0523s. %OS requirement met but peak time requirement is not exactly as wanted, still sufficiently close. Rounding up numbers damages the accuracy of experiment, also connecting discrete time values can misguide, especially such as this kind of low peak time.

After changing sample time -1 to 0.0001 using max function %OS calculated as 2.79 and peak time calculated as 0.0505s. After adding one more digit after point, %OS calculated as 2.49 and peak time calculated as 0.0504s

Question 2)

These kind of reference signals calculating %OS and peak time is not logical but as we can see at Figure 4, system response has so high %OS and it is far away from meeting peak time criterion.

Question 3)

As be seen at Figure 5 magnitude gets lower as frequency gets higher and there is phase shifting, that is why peak time criterion cannot meet. It matches with question 2.

Question 4)

As can be seen at bode plot from question 3 magnitude gets lower as frequency get higher. So, searching for $Max(\sin_out) < Max(\sin_input) * 1.1$ will be enough. When frequency is 32Hz output value equals exactly 1.1times input. For bigger frequency values than 32Hz condition will not be satisfied. Wanted range of frequency: 0-32Hz.