LAB-2 EXPERIMENT

Please follow the instructions in the document and mail your pdf-files to the TA of your section

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Please name your pdf files as in the given example file:

Mehmet-Ali-Demir-111211102-lab-1-preliminary-G-3.pdf

Mehmet-Ali-Demir-111211102-lab-1-labreport-G-3.pdf

ALSO STATE YOUR SECTION in the E-MAIL, [there are 3 sections]

section-1 TA: Mehmet Karahan,

section-2 TA: Mehmet Karahan,

section-3 TA: Artun Sel.

PLEASE READ "Important Rules" section at the end of this document before submitting your document.

THE DEADLINE: Friday, November 4, 2022, 20:00.

WARNING: Any work submitted at any time within the first 24 hours following the published submission deadline will receive a penalty of 10% of the maximum amount of marks available. Any work submitted at any time between 24 hours and up to 48 hours late will receive a deduction of 20% of the marks available

Contents

The Experimental Study

Task 1 [Hardware-Experiment]

1) In **Figure 1**, **P-control [integral-control]** system is given. Using PID-control board, oscillator and signal-generator, set-up the connections given in **Figure 1**.
2) The signal-generator settings are given in **Table 1**.
3) In PID-control Board, set $\boxed{K_P = 1}$. Then Measure [Using Oscilloscope] input-signal [input to the PID-block] and output signal [output of the PID-block]. Record these measurements [by taking a photo of the oscillator screen] and interpret the relationship between input-signal and output-signal.

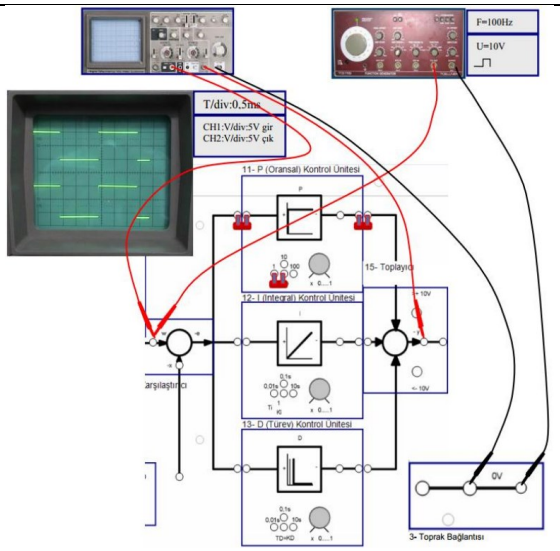

Figure 1: P (proportional) control system set-up

Table 1: Signal Generator Settings

Signal waveform type	Sine Wave
Frequency	10 Hz
Amplitude	0.5 V
Offset	0 V

Task 2 [Hardware-Experiment]

1) In **Figure 1**, **P-control [integral-control]** system is given. Using PID-control board, oscillator and signal-generator, set-up the connections given in **Figure 1**.
2) The signal-generator settings are given in **Table 1**.
3) In PID-control Board, set $\boxed{K_P = 10}$. Then Measure [Using Oscilloscope] input-signal [input to the PID-block] and output signal [output of the PID-block]. Record these measurements [by taking a photo of the oscillator screen] and interpret the relationship between input-signal and output-signal.

Task 3 [Hardware-Experiment]

1) In **Figure 2**, **I-control [integral-control]** system is given. Using PID-control board, oscillator and signal-generator, set-up the connections given in **Figure 2**.
2) The signal-generator settings are given in **Table 2**.
3) In PID-control Board, set $\boxed{T_i = 0.01sec}$. Then Measure [Using Oscilloscope] input-signal [input to the PID-block] and output signal [output of the PID-block]. Record these measurements [by taking a photo of the oscillator screen] and interpret the relationship between input-signal and output-signal.

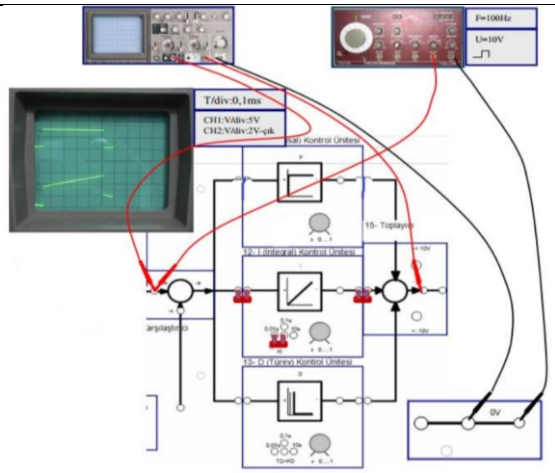

Figure 2: I (integral) control system set-up

Table 2: Signal Generator Settings

Signal waveform type	Sine Wave
Frequency	5 Hz
Amplitude	0.2 V
Offset	0 V

Task 4 [Hardware-Experiment]

1) In **Figure 2**, **I-control [integral-control]** system is given. Using PID-control board, oscillator and signal-generator, set-up the connections given in **Figure 2**.
2) The signal-generator settings are given in **Table 2**.
3) In PID-control Board, set $\boxed{T_i = 0.1sec}$. Then Measure [Using Oscilloscope] input-signal [input to the PID-block] and output signal [output of the PID-block]. Record these measurements [by taking a photo of the oscillator screen] and interpret the relationship between input-signal and output-signal.

Task 5 [Hardware-Experiment]

1) In **Figure 3**, **D-control [derivative-control]** system is given. Using PID-control board, oscillator and signal-generator, set-up the connections given in **Figure 3**.
2) The signal-generator settings are given in **Table 3**.
3) In PID-control Board, set $\boxed{T_D = 0.01sec}$. Then Measure [Using Oscilloscope] input-signal [input to the PID-block] and output signal [output of the PID-block]. Record these measurements [by taking a photo of the oscillator screen] and interpret the relationship between input-signal and output-signal.

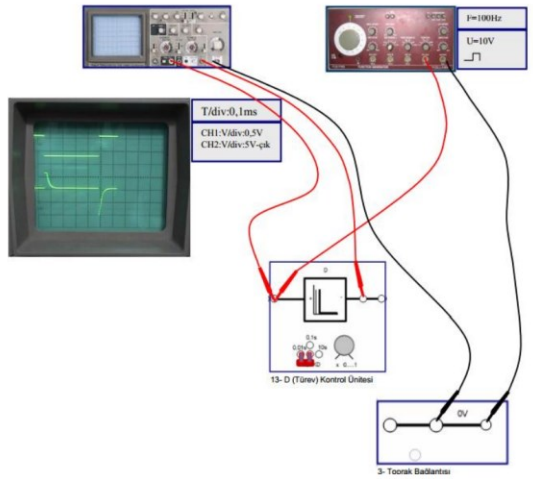

Figure 3: D (derivative) control system set-up

Table 3: Signal Generator Settings

Signal waveform type	Sine Wave
Frequency	4 Hz
Amplitude	0.2 V
Offset	0 V

Task 6 [Hardware-Experiment]

1) In **Figure 3**, **D-control [derivative-control]** system is given. Using PID-control board, oscillator and signal-generator, set-up the connections given in **Figure 3**.
2) The signal-generator settings are given in **Table 3**.
3) In PID-control Board, set $\boxed{T_D = 0.1sec}$. Then Measure [Using Oscilloscope] input-signal [input to the PID-block] and output signal [output of the PID-block]. Record these measurements [by taking a photo of the oscillator screen] and interpret the relationship between input-signal and output-signal.

Task 7 [Software-Experiment]

Using matlab-simulink, simulate the block diagram given in Figure 4 by using the parameters stated in Table 4 and Table 5. Plot the 3 signals with the colors 1-black,2-red,3-blue. Interpret the relationship between the signals that are measured by the scope.

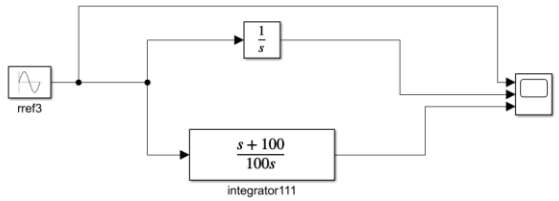

Figure 4: Simulink Block diagram

Table 4: Sine-wave-parameters

Amplitude	1
Frequency(rad/sec)	2π[1]

Table 5: Simulation Settings

Simulation Duration	10 sec

Task 8 [Software-Experiment]

Using matlab-simulink, simulate the block diagram given in Figure 5 by using the parameters stated in Table 6, Figure 6, and Table 7. Plot the 3 signals with the colors 1-black,2-red,3-blue. Interpret the relationship between the signals that are measured by the scope.

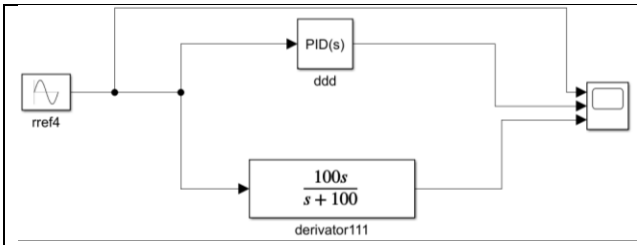

Figure 5: Simulink Block diagram

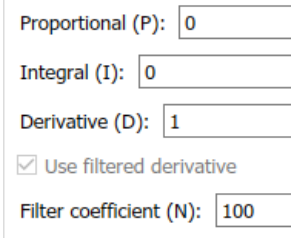

Figure 6: PID parameters

Table 6: Sine-wave-parameters

Amplitude	1
Frequency(rad/sec)	2π[1]

Table 7: Simulation Settings

Simulation Duration	10 sec

Task 9 [Software-Experiment]

Using matlab-simulink, simulate the block diagram given in Figure 7 by using the parameters stated in Table 8. Plot the 2 signals with the colors 1-black,2-red. Interpret the relationship between the signals that are measured by the scope.

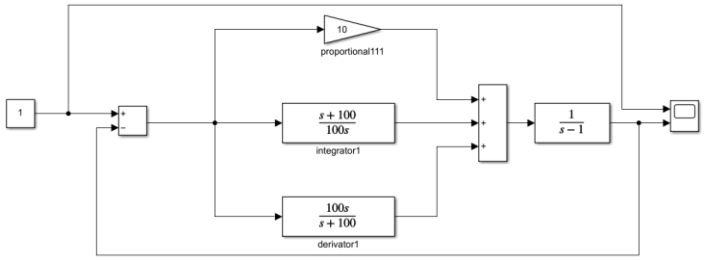

Figure 7: Simulink Block diagram

Table 8: Simulation Settings

Simulation Duration	100 sec

Task 10 [Software-Experiment]

Using matlab-simulink, simulate the block diagram given in Figure 8 by using the parameters stated in Table 9. Plot the 2 signals with the colors 1-black,2-red. Interpret the relationship between the signals that are measured by the scope.

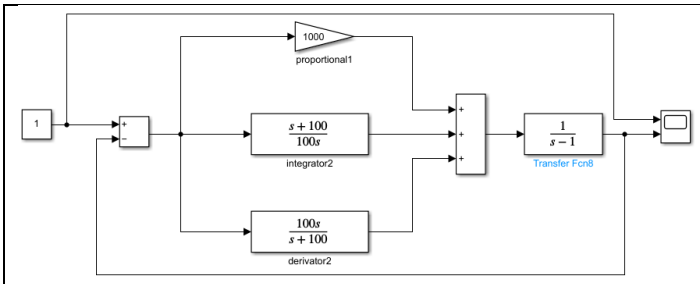

Figure 8: Simulink Block diagram

Table 9: Simulation Settings

Simulation Duration	100 sec

Important Rules

The following is the list of the rules that must be followed. The failure of following the rules listed below will be resulted in point-deduction as stated in the table.

No.	Rule	Corresponding point-deduction for the failure of following the rule
01	The document must be mailed to the TA of the section	5 pt.
02	The pdf file must be named as stated at the top of the document.	5 pt.
03	The file must be in pdf format.	5 pt.
04	Section-name must be stated in the mail that is to be sent to submit the **lab-report** or **preliminary** document	5 pt.
05	The deadline must be met.	10 pt. for each day after the deadline
06	The file must be prepared in digital form. MSword or Latex must be used.	5 pt.
07	All plots must be on a white background and the lines must be clearly visible. The names of the signals in the plot must be stated [either by using legend or by using appropriate Figure Naming such as "Figure 1: (red) input signal, (blue) output signal"]	3 pt.
08	All figures must be numbered.	3 pt.
09	All tables must be numbered.	3 pt.
10	All equations must be numbered.	3 pt.
11	References must be added. Only books are allowed. Do not use internet sources. Example references: [1] "Modern Control Engineering 5th Ed", Ogata K., 2010, Prentice Hall [2] "Linear Systems Theory 2nd Ed", Hespanha J., 2018, Princeton Press	3 pt.
12	Font style must be consistent. Times-New-Roman or Palatino-Linotype must be used. Font size must be 11.	3 pt.
13	Interpret the findings in each task accordingly.	5 pt.