LAB-1 EXPERIMENT

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

artunsel@gmail.com,

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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, October 28, 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

Task-1

Find the transfer function of the system given below.

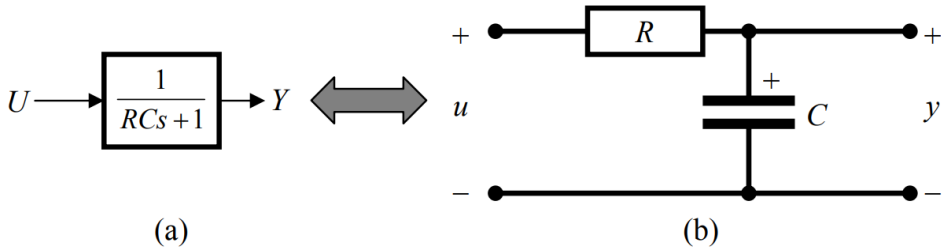

Figure 1: RC Circuit, a simple dynamical system (1st order)

Table 1: The Circuit Parameters

Parameter	Value
R	$1k\Omega$
C	$1\mu F$

Task-2

Set up the circuit whose diagram and the parameter values are given below.

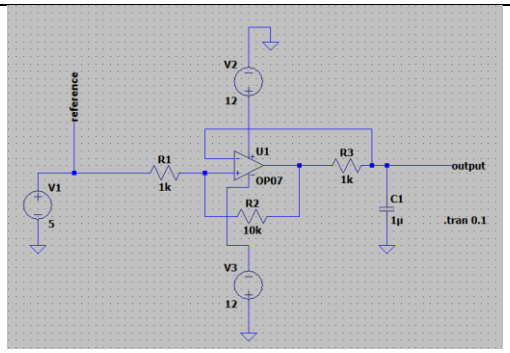

Figure 2: Op-amp circuit

The circuit parameters are given in the table below.

Table-2: The circuit parameters

The parameter	Value
R_1	$1k\Omega$
R_2	$10k\Omega$
R_3	$1k\Omega$
C_1	$1\mu F$
Op-amp V^+	$+12V$
Op-amp V^-	$-12V$
Op-amp	Type:741

Apply $\boxed{V_{ref} = 5\ V}$. Then measure "reference-voltage-signal", "output-voltage-signal" and "input-voltage-signal". [the input-voltage-signal is the output of op-amp]

Task-3

Using the circuit that is stated in Figure-2, Apply

$$\boxed{V_{ref} = 5sgn(\sin(2\pi[10]t)), \forall t \geq 0}$$

Then measure "reference-voltage-signal", "output-voltage-signal" and "input-voltage-signal". [the input-voltage-signal is the output of op-amp]

Task-4

Using the circuit that is stated in Figure-2, Apply

$$\boxed{V_{ref} = 5\sin(2\pi[10]t), \forall t \geq 0}$$

Then measure "reference-voltage-signal", "output-voltage-signal" and "input-voltage-signal". [the input-voltage-signal is the output of op-amp]

Task-5

Using the circuit that is stated in Figure-2, Apply

$$\boxed{V_{ref} = 5\sin(2\pi[50]t), \forall t \geq 0}$$

Then measure "reference-voltage-signal", "output-voltage-signal" and "input-voltage-signal". [the input-voltage-signal is the output of op-amp]

Task-6

Simulate the given closed-loop feedback control-system whose block diagram is given below.

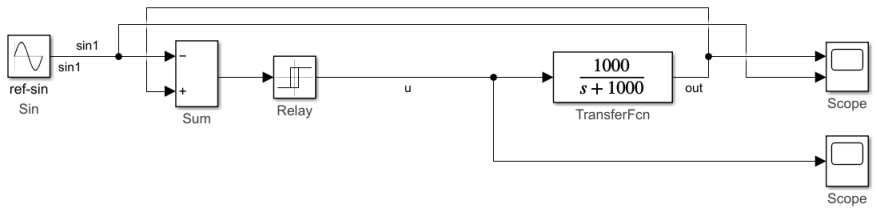

Figure 3: Block diagram

The reference-signal sine wave is defined as,

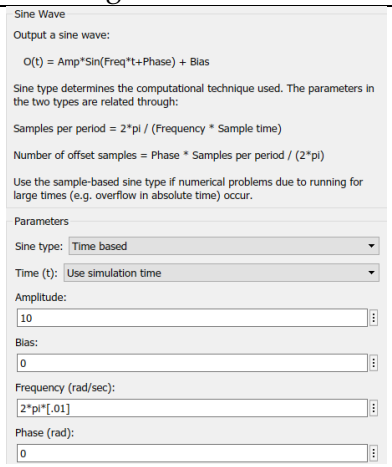

Figure 4: sine properties

The relay component is defined as,

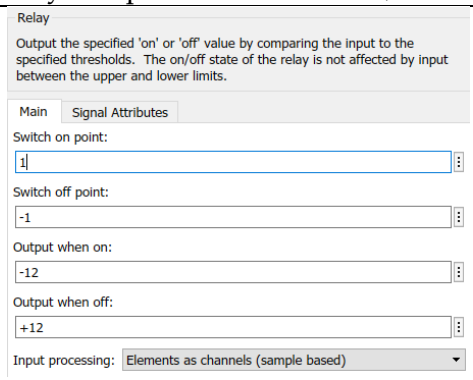

Figure 5: RELAY properties

Simulation parameters are given in the Table-3.

Table 3: The simulation parameters

Simulation parameters	Value
Simulation Duration	$100\ s$
Max-Step Size	$1e-5$ [Which means $\boxed{10^{-5}\ s}$ in MATLAB]

Then plot the reference-signal and output-signal on top of each other. Additionally, plot the control-input-signal.

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 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	Reference 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.