Al-Ahliyya Amman University
Faculty of Engineering
Department of Electrical Engineering

Control systems lab
Experiment (3)

Second order differential equation

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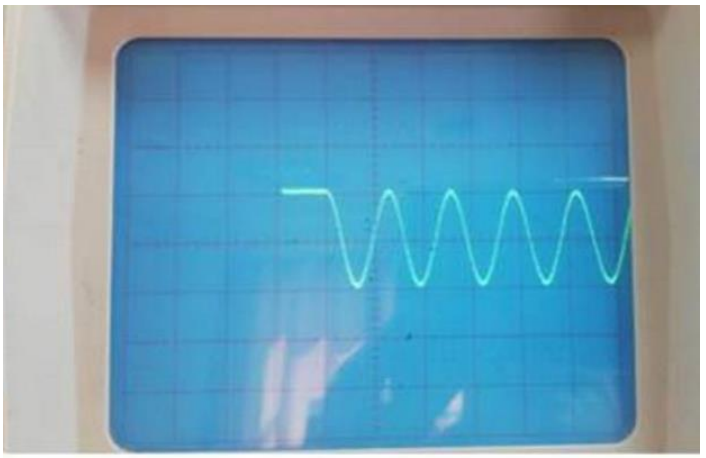
Objective:

*To know how to solve a simple second order differential equation using two integrators and inverting amplifier

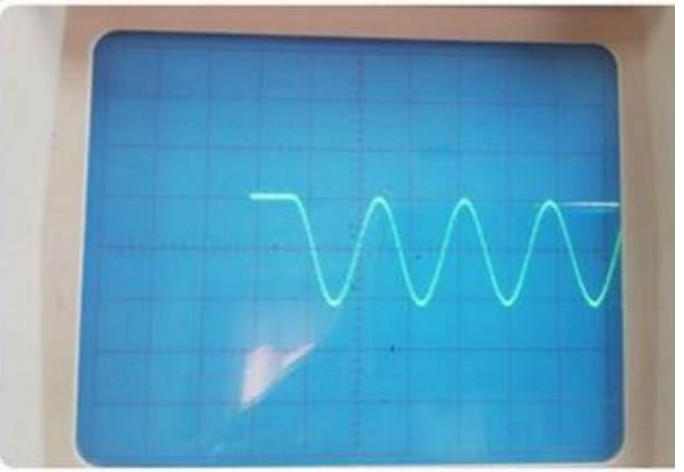
*To understand how to introduce initial conditions into the operation of the integrators .

*To understand the concept of damping.

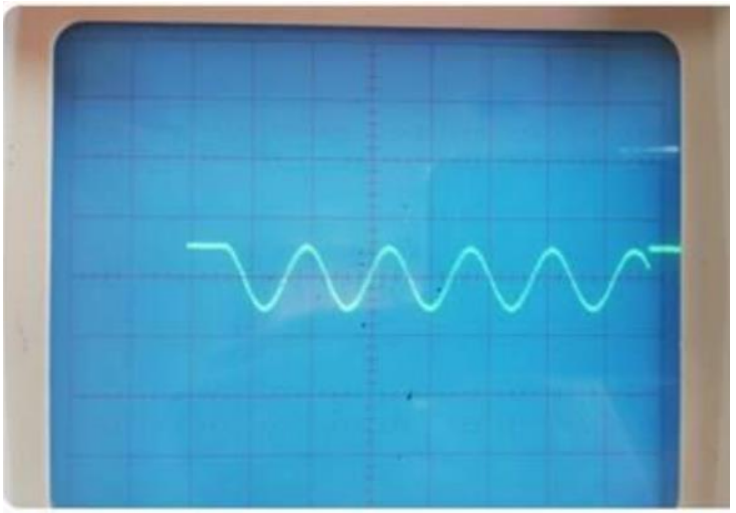
Oscilloscope divisions for all figures are :
Vertical 2v/div
Time 0.5sec/div



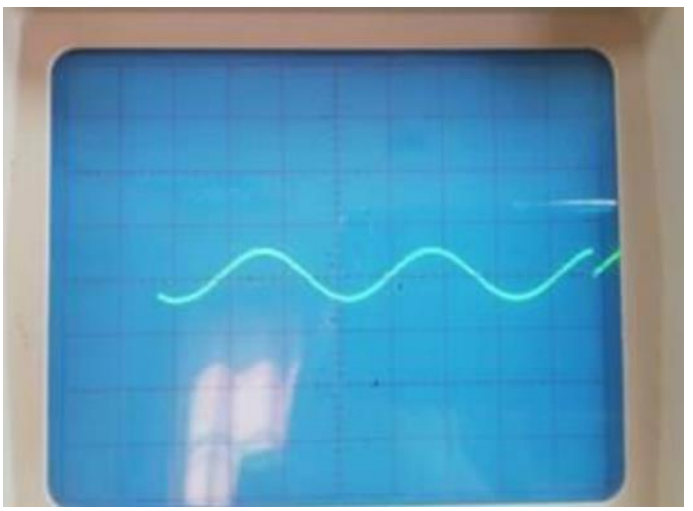
X=2 g/L=100



X=2 g/L =50



X=1 g/L= 80



X=1 g/L=20

Part A:

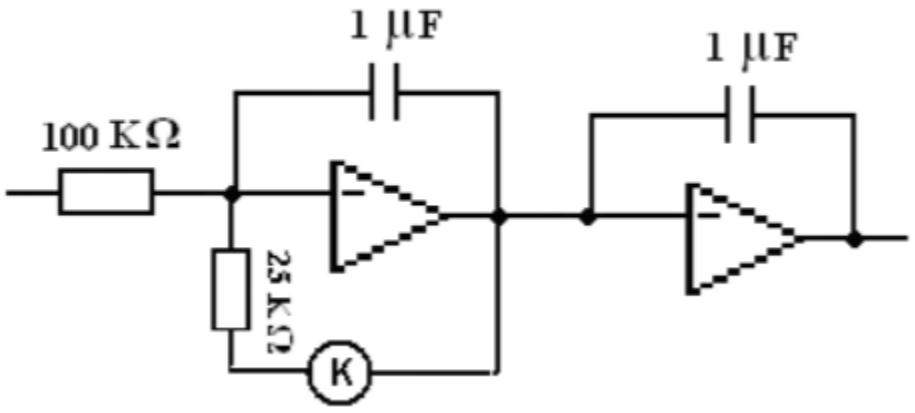
1) Connect the block shown in figure 3.1, Connect the oscilloscope to the output (X)
2) Set the potentiometer (g/L) to 50 and switch to compute
3) Observe the output on the oscilloscope, what happened?
It will not display anything (because there is no initial value)
4) Set the initial value (initial displacement x) to -2v, what do you notice?
It will display undamped signal(sine wave oscillate forever)
5) Fill the results in table 3.1
6) Sketch all the outputs.

Initial displacement	(g/L)	Amplitude (Vp-p)	Periodic time of the oscillation
X= -2V	100	4v	0.65 sec
	50	4v	0.85sec
X= 1V	80	2v	0.7sec
	20	2v	2sec

Q3.1) How does the amplitude of the oscillation compared with the initial displacement? the amplitude of the signal increases by increasing the initial displacement
Q3.2) How does doubling the length of the string (L) Affect:
a) The periodic time of the oscillation? increase
b) The amplitude of the oscillation? Remain the same

Q3.3) The pendulum can oscillate by giving it velocity of 2 v. Show how is this simulated? The signal will be reversed
(وكاننا فقط قمنا بتغيير اتجاة بداية التأرجح)

Part B: Damping



Make this connection and describe what happened to the output?

The signal will stop oscillating after a specified period of time (It'll not oscillate for ever)>>>>Damping

conclusion:

-We must add an initial value to the circuit to display the signal(The pendulum will not start to oscillate if we do not give it an initial value)

-The time period and the amplitude depend on the length of the string

-The amplitude of the signal increases by increasing the initial displacement