Experiment 8:
Op-Amp Circuits

Post-Lab Report

A.

Prove theoretically that for an ideal op-amp

$$V_o = -\frac{R_2}{R_1} V_I$$

For an ideal operational amplifier
Vp=Vn=0 in this case
Applying KCL on the negative inverting node
Vn-V1)/R1] + [(Vn-Vo)/R2] = 0 with Vn=0)]
V1/R1=Vo/R2-
Thus, Vo= -(R2*V1)/R1
(Vo=-V1*(R2/R1

Can you find a relationship between the low -frequency gain and bandwidth?

The bandwidth in this case is equal to the frequency at which the magnitude of the gain Vo/VI drops to 1/√2 of its low frequency =R2/R1 The absolute value of the gain: |A|= Vo/V1 = R2/R 1. To find a relation :between the low-frequency gain and bandwidth, we refer to our experimental results
For gain = 10, bandwidth = 91 KHz
For gain = 4.54, bandwidth = 95 Hz
We can conclude that when gain increases the bandwidth decreases and hence they are inversely proportional

B.

Prove theoretically that for an ideal op-amp

$$V_o = \left(1 + \frac{R_2}{R_1}\right) V_I$$

For an ideal op-amp: Vn=Vp=V1 as indicated in the figure
:Applying KCL for the negative inverting node
V1/R1+(V1-Vo)/R2=0
Vo= R2(V1/R1) + V1
(Vo= V1*(1 + R2/R1

C.

How does this bandwidth compare with that of the non-inverting amplifier?

The bandwidth of the non-inverting op-amp is equal to the frequency at which the magnitude of the gain drops to of its low frequency value (which, theoretically, is 1+R2/R1.)

E.

Prove theoretically that for an ideal op-amp

$$V_o = -\frac{1}{RC}\int V_I dt$$

To verify experimentally, you should prove that the peak to -peak output voltage is equal, in absolute value, to the area enclosed under the square wave (for 0 < t < T/2 or for T/2 < t < T) divided by the product RC.

V1-Ri=0
i=V1/R
0-Vcapacitor=Vo
-i=CdVo/dt
dVo/dt=-i/C=-V1/RC
Vo=-V1/RCdt
Vo=-1/RC∫V1dt

F.

Prove theoretically that for an ideal op-amp

$$V_o = -RC\,\frac{dv_I}{dt}$$

To prove experimentally, you should prove that the output voltage level is equal, in absolute value, to the product RC multiplied by the slope of the triangular input signal.

Vo=R icapacitor
Icapacitor=-Cdv/dt
Vo=-RCdV1/dt