QUAID-E-AWAM UNIVERSITY OF ENGG: SCI: & TECHNOLOGY, NAWABSHAH.
DEPARTMENT OF ELECTRONIC ENGINEERING
I.C. DESIGN AND APPLICATION (1st Term, 3rd Year)
Lab Experiment # 03

Name: ______________________ **Roll # :** ______________

Score: __________ **Signature:** __________________ **Date:** __________

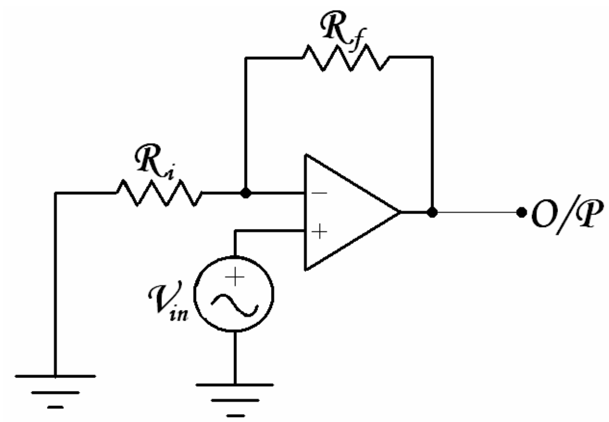
Non-Inverting Amplifier & Frequency Response

OBJECTIVE:

- To understand the operation of Non-Inverting Amplifier.
- Observe the close loop frequency response of the inverting amplifier.
- To determine the max: operating frequency.

EQUIPMENTS:

- Oscilloscope.
- Function generator.
- DC power supply (± 12V).
- Digital Multimeter.
- Breed board
- Connecting wires.
- Op-Amp I.C 741.
- Few Resistors



THEORY DISCUSSION:

The operational amplifier is a dc amplifier which can amplify both positive and negative signals and give positive or negative outputs. The amplifier has a differential input and very high gain. When operated in a closed loop the gain can be very closely controlled by resistors.

An Op-Amp connected in a closed loop configuration as a non-inverting amplifier is shown in figure # 1,

The input is applied to the non-inverting (+) input. A portion of the output is applied back to the inverting (-) input through the feedback network. This constitutes negative feedback. The feedback fraction is the portion of the output returned to the inverting input and determines the gain of the amplifier. This small feedback voltage, V_f can be written as,

$$V_f = \beta V_{out} \quad \text{……………… (1).}$$

Where, $$\beta = \frac{R_i}{R_f + R_i} \quad \text{……………(2).}$$

The differential voltage, V_{diff} between the Op-Amps input terminals can be expressed as,

$$V_{diff} = V_{in} - V_f \quad \text{…………………(3).}$$

This input differential voltage is forced to be very small as a result of the negative feedback.

$V_{in} \cong V_f$.

The ratio of the output voltage to the input voltage is the closed-loop gain. This result shows that the close-loop gain for the non-inverting amplifier is,

$$A_{cl(NI)} = \frac{V_{out}}{V_{in}} \cong \frac{1}{\beta}$$

This can also be stated as,

$$A_{cl(NI)} = \frac{R_f}{R_i} + 1 \text{……………..(4).}$$

SLEW RATE:

The maximum rate of change of output voltage when a step input voltage is applied to op-amp. Mostly for op-amps $0.5V/\mu sec$ is a typical value of slew rate.
Slew rate is also used to determine the max: operating frequency of an op-amp.

$$f_{max} = \frac{Slew\ Rate}{2\pi V_p} \text{………………………(2)}$$

From the equation(2) it is clear that as the operating frequency increases the output voltage will decrease and vice versa. This means that;

- To operate op-amp for large signals the input frequency should be decreased.
- To operate op-amp at higher frequencies the output (gain) should be decreased.

PROCEDURE:

1. Assemble the circuit shown in figure # 01.
2. Apply +1 V dc input and measure the output.
3. Calculate the gain for measured values and compare it with equation # 4.
4. Now apply 2V/1kHz AC signal to the non-inverting input.
5. Measure the output and again calculate the gain.
6. Compare the gain with calculated gain from eq: 4.

RESULTS AND OBSERVATIONS

	R_f	R_i	V_{in}	V_{out}	Calculated gain $(1+R_f/R_i)$	Measured gain (V_{out}/V_{in})	f_{max}	
							Calculated	Measured

Review Question

Q # 01. What is a non-inverting amplifier?
Ans: ____________________

Q # 02. On what values the gain of non-inverting amplifier depends?
Ans: ____________________

Q # 03. How can we control the gain of an Amplifier?
Ans: ____________________

Q # 04. The feedback voltage is the voltage drop across which resistor?
Ans: ____________________

CONCLUSIONS: ____________________.