SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF COMPUTER SCIENCE AND DESIGN

COURSE NAME : 19EE01 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

I YEAR /II SEMESTER - COMPUTER SCIENCE AND DESIGN

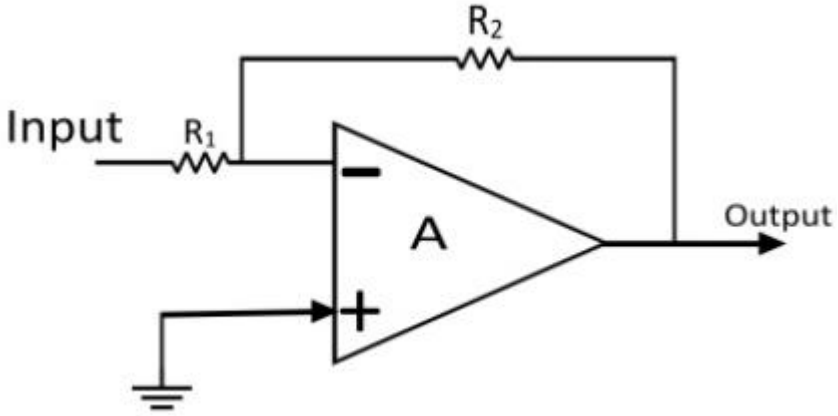
Unit 5 – LINEAR AND DIGITAL ELECTRONICS

Topic 2 : Inverting and Non-inverting Amplifiers

An **operational amplifier** is a three-terminal device consisting of two high impedance input terminals, one is called the **inverting input** denoted by a negative sign and the other is the **non-inverting input** denoted with a positive sign. The third terminal is the output of the Op-Amp.

Inverting Operational Amplifier

In the inverting operational amplifier circuit, the signal is applied at the inverting input and the non-inverting input is connected to the ground. In this type of **amplifier**, the output is 180º out of phase to the input, i.e. when positive signal is applied to circuit, the output of the circuit will be negative. By assuming the Op-Amp is ideal, then the concept of virtual short can be applied at the input terminals of the Op-Amp. So that voltage at the inverting terminal is equal to the voltage at non-inverting terminal.



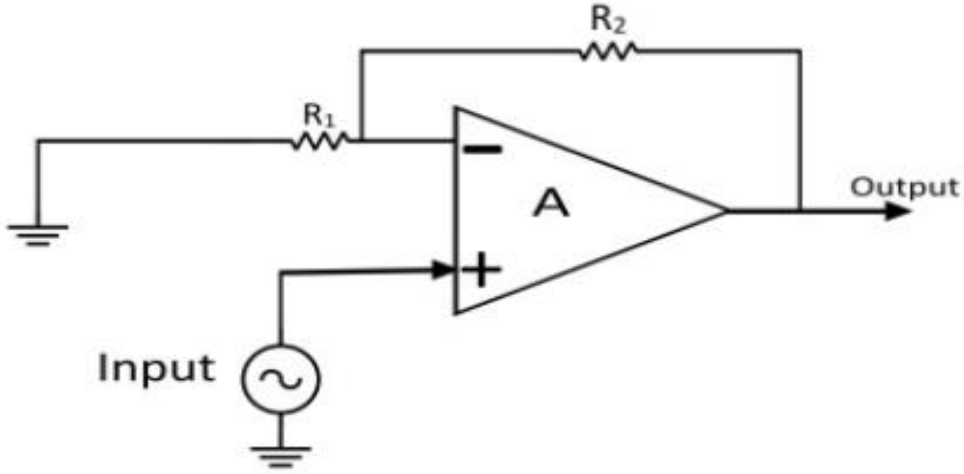
Applying KCL at inverting node of Op-Amp

$$\frac{0 - V_{in}}{R_1} + \frac{0 - V_{out}}{R_2} = 0$$

$$\text{Voltage Gain}(A_v) = \frac{V_{out}}{V_{in}} = -\frac{R_2}{R_1}$$

Non-Inverting Operational Amplifier

When the signal is applied at the non-inverting input, the resulting circuit is known as Non-Inverting Op-Amp. In this amplifier the output is exactly in phase with the input i.e. when a positive voltage is applied to the circuit, the output will also be positive. By assuming the Op-Amp is ideal, then concept of virtual short can be applied i.e. the voltage at the inverting and non-inverting terminal is equal.



Applying KCL at the inverting node

$$\frac{V_{in} - V_{out}}{R_2} + \frac{V_0 - 0}{R_1} = 0$$

$$\text{Voltage Gain}(A_v) = \frac{V_{out}}{V_{in}} = 1 + \frac{R_2}{R_1}$$

Difference between Inverting and Non-Inverting Op-Amps

Inverting Op-Amp	Non-Inverting Op-Amp
The type of feedback used is voltage shunt.	The type of feedback used is voltage series.
The input and output voltages of this amplifier are 180° out of phase.	The input and output voltages are in phase.
$\text{Voltage Gain}(A_v) = \frac{V_{out}}{V_{in}} = -\frac{R_2}{R_1}$	$\text{Voltage Gain}(A_v) = \frac{V_{out}}{V_{in}} = 1 + \frac{R_2}{R_1}$
The input impedance is R1.	The input impedance is very high.

REFERENCES

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THANK YOU