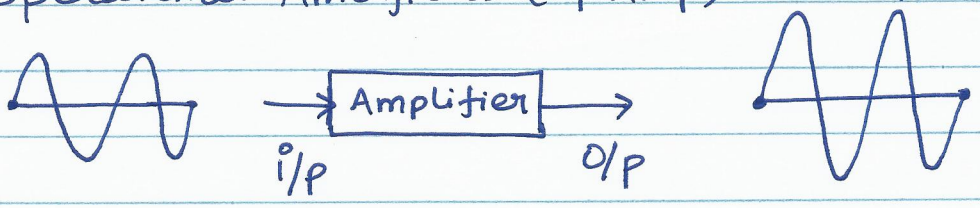
Savan Suri

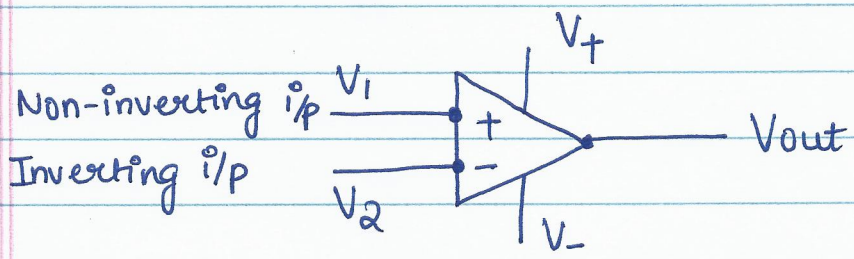
EE 356 - Analog Electronics LAB
LAB 1 - Intro. to Amplifiers.

Operational Amlifiers (Op Amp) ⇒ Amplify input Signal



In pre digital era, op amps were used to conduct mathematical operations such as addition, subtraction, integration, differentiation, averaging etc.

i/p ⇒ input
o/p ⇒ output



An op amp is a differential Amplifier. It amplifies the difference between the two signals.

$$\therefore \quad V_{out} = A(V_1 - V_2)$$

$$\Rightarrow \quad \boxed{A = \frac{V_{out}}{V_1 - V_2}}$$ where A is Gain of the amplifier (Op Amp).

when V_2 is grounded, i.e $V_2 = 0$

then, $$\boxed{A = \frac{V_{out}}{V_1}}$$

A is called Open loop Gain with NO FEEDBACK

Similarly, when V_1 is grounded i.e $V_1 = 0$; then

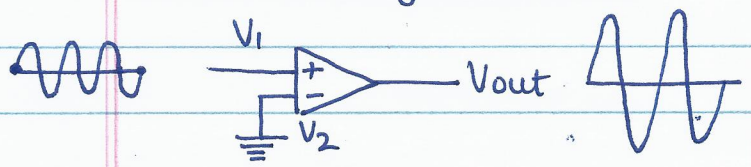
$$A = \frac{-V_{out}}{V_2}$$

'-ve' sign indicates the inversion of signal. i.e 180° phase shift.

* Note that, for ~~a~~ non-inverting amplifier, there is no phase shift. ⇒ 0° phase shift

for an inverting amplifier, there is a 180° phase shift ⇒ signal looks inverted! (Hence the name)

Non-Inverting Amplifier.

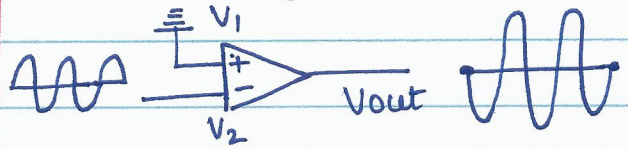


A = 2 ; Amplitude increases by twice

phase diff = 0°

$V_{out} = A \cdot v_1$

Inverting Amplifier

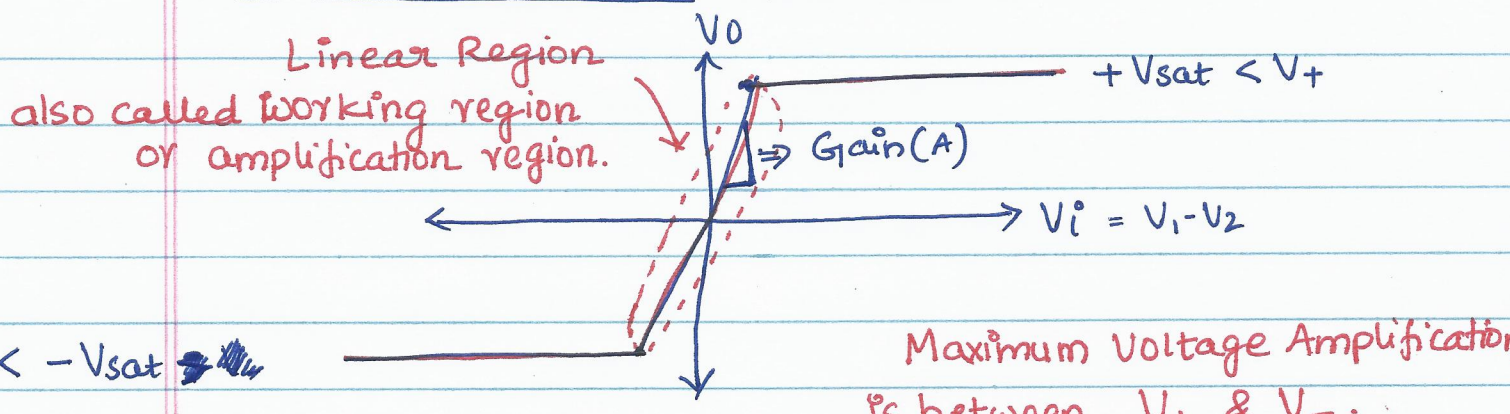


A = 2 ; Amplitude multiplies by two

phase diff = 180°

$V_{out} = -A \cdot V_2$.

Voltage Trasfer Curve of an Op Amp (Ideal) :-



Maximum Voltage Amplification is between V_+ & V_-.

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Applications of an Op-Amp :-

Can be used as
1. Active filter.
2. Oscillators
3. Wave form Convertor
4. Analog to Digital Convertor (ADC)
5. Digital to Analog Convertor (DAC). etc.

IC 741 is a very versatile ⇒ Many applications.

IDEAL OP-AMP CHARACTERISTICS :-

			Practically,
1.	∞	i/p impedance	(in MΩs)
2.	0	o/p impedance	(few Ωs)
3.	∞	open loop gain ($A = \infty$)	(10^4-10^6)
4.	$V_{out} = 0$	when $V_{in} = 0$	($V_{out} \approx$ mV)