1.8 OPEN LOOP CONFIGURATION OF OP AMP

Open Loop Configuration of Op amp – The simplest possible way to use an op-amp is in the open loop mode. Since the gain is very large in open loop condition the output voltage Vo is either at its positive saturation voltage +Vsat or –ive saturation voltage –Vsat as V1>V2 or V2>V1 Respectively.

The Figure 1.8.1 shows an op amp in the open loop condition.

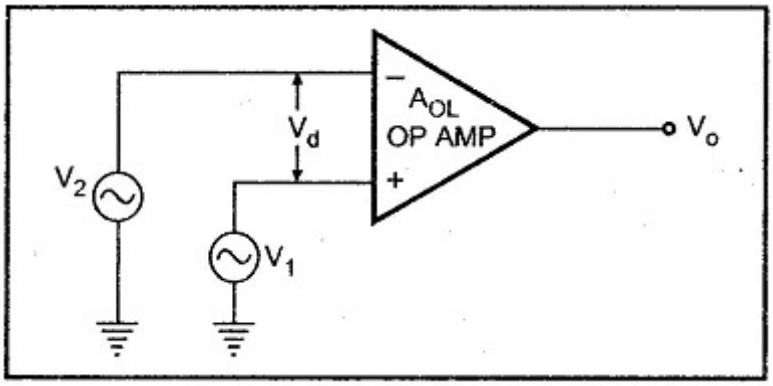

Figure 1.8.1Open loop operation of op-amp

[source: https://www.brainkart.com/subject/Linear-Integrated-Circuits_220/]

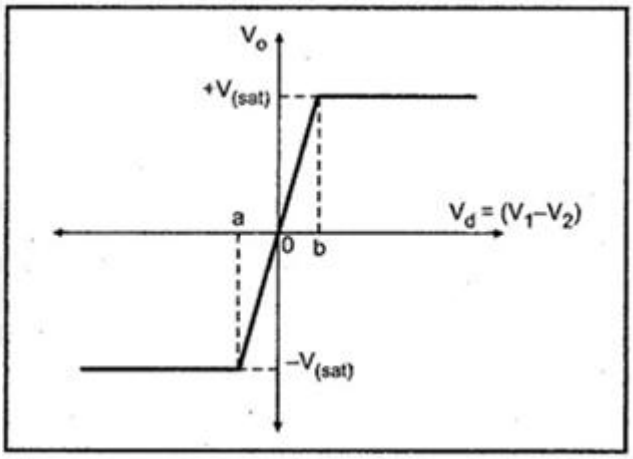

Figure1.7.2Voltage transfer characteristics

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For small range of input signal from point a to b it behaves linearly.This range is very small & practically due to high open loop gain op-amp either shows $+V_{sat}$ or $-V_{sat}$ level. This indicates the inability of op-amp to work as a linear small amplifier in the

open loop mode.Hence the op-amp is generally not used We know that the d.c. supply voltages applied to the op-amp are V_{cc} and $-V_{EE}$ and the output varies linearly only between V_{CC} and $-V_{EE}$.Since gain is very large in open loop condition, the output voltage V, is either at its positive saturation voltage ($+Vs_{at}$) or negative saturation voltage ($-V_{sat}$) as $V_1 > V2$ or $V2 > V_i$ respectively. This is shown in the Figure 1.8.2.Thus very small noise voltage present at the input also gets amplified due to its high open loop gain and op-amp gets saturated. It can be seen from the Fig.2 only for small range of input signal (from point a to b), it behaves linearly. This range is very small and practically due to high open loop gain, op-amp either shows + V_{sat} or – V_{sat} level.This indicates the inability of op-amp to work as a linear small signal amplifier in the open loop mode. Hence, the op-amp is generally not used in the open loop configuration. Such an open loop behavior of the op-amp finds some rare applications like voltage comparator, zero crossing detector etc.

CLOSED LOOP CONFIGURATION OF OP AMP

The utility of op-amp increases considerably if it is used in a closed loop mode. The Closed Loop Configuration of Op amp is possible using feedback. The feedback allows to feed some part of the output back to the input. In linear applications the op-amp is always used with negative feedback. The feedback helps to control gain which otherwise drives op-amp into saturation.

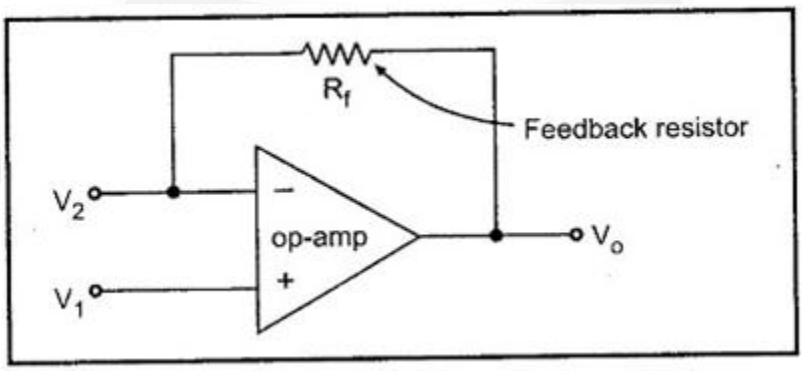

Figure 1.8.3 op-amp with negative feedback

[source: https://www.brainkart.com/subject/Linear-Integrated-Circuits_220/]

The negative feedback is possible by adding a resistor as shown figure1.8.3 Called **feedback resistor.** The feedback is said to be negative as the feedback resistor connects the output to the inverting input terminal.

The gain resulting with feedback is called **closed loop gain** of the op-amp. Due to feedback resistance there is reduction in the gain. The closed loop gain is much less than the open loop gain and is independent of it. Most of the linear circuits use op-amp in a closed loop mode with negative feedback with R_f. This is because, due to reduced gain, the output is not driven into the saturation and the circuit behaves in a linear manner.