Zener diode

Fig Symbol for Zener diode

Zener diode is a reverse biased heavily doped semiconductor (silicon or germanium) PN junction diode, which is operated exclusively in the breakdown region. The symbol of a Zener diode is shown in Fig For normal operation of a Zener diode, in breakdown region, the current through the diode should be limited by an external circuit. Hence the power dissipated across the junction is within its power-handling capacity. Unless this precaution is observed, a large current will destroy the diode. The V-I characteristic curve for the Zener diode is shown in Fig. It can be seen from the figure, that, as the reverse voltage applied to the PN junction is increased, at a particular voltage, the current increases enormously from its normal cut off value. This voltage is called zener voltage or breakdown voltage (Vz).

FEEDBACK IN AMPLIFIERS

The characteristics of an amplifier are highly dependent on transistor parameters like current gain, input impedance and output impedance etc. The transistor parameters exhibit variations due to ageing of transistors. Manufacturing processes cause variations in parameters of transistors of the same type. To overcome any adverse effect on the overall performance of an amplifier, feedback is used. Feedback is said to exist in an amplifier circuit, when a fraction of the output signal is returned or fed back to the input and combined with the input signal. If the magnitude of the input signal is reduced by the feed back, the feed back is called negative or degenerative. If the magnitude of the input signal is increased by the feed back, such feed back is called positive or regenerative.

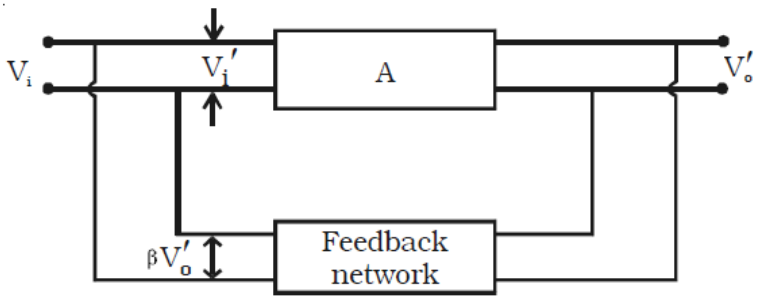
Principle of feedback amplifier

For an ordinary amplifier i.e. without feedback, let V0 and Vi be the output voltage and input voltage respectively. If A be the voltage gain of the amplifier, then

$$\mathbf{A = V_O / V_i}$$

The gain A is often called as open–loop gain. The general theory of feedback can be explained with the help of block diagram shown in Fig 9.39. The feedback amplifier has two parts (i.e) amplifier and feedback circuit. The feedback circuit usually consists of passive components (resistor, capacitor, inductor). A fraction (say β) of the output voltage is fed back to the input through the feedback circuit. Let V′ o be the output voltge with feedback.

Feedback amplifier



Therefore, after feedback the input voltage V′ i becomes,

V′ i = Vi + βV′ o ... (1)

For positive feedback, β is taken as positive. For negative feedback, β is taken as negative.

For positive feedback, the input voltage will be Vi + βV′ o. When this is amplified A times by the amplifier, the output voltage after feedback (V′ o) will be A(Vi + βV′ o)

∴ V′ o = A (Vi + βV′ o) ... (2)

V′ o (1– βA) = AVi ... (3)

Then the voltage gain of the amplifier with feedback is

$Af = V'o/V\iota = A/1- \beta A$

Since $|1-\beta A| < 1$, $Af > A$. The positive feedback increases the amplifier gain.

For negative feedback, the feedback fraction is – β

$\therefore Af = A/1- (-A\beta) = A/1 + A\beta$

Since $|1+\beta A| > 1$, $Af < A$. Therefore negative feedback reduces the amplifier gain. The term Aβ is called loop gain and β is called feedback ratio.