Hands out on Fedback in amplifier

A- Basic principles and types of feedback

⇨ Feedback is the process by which a fraction or part of output energy of an amplifier is injected back to combine with its input as shown in the diagram:

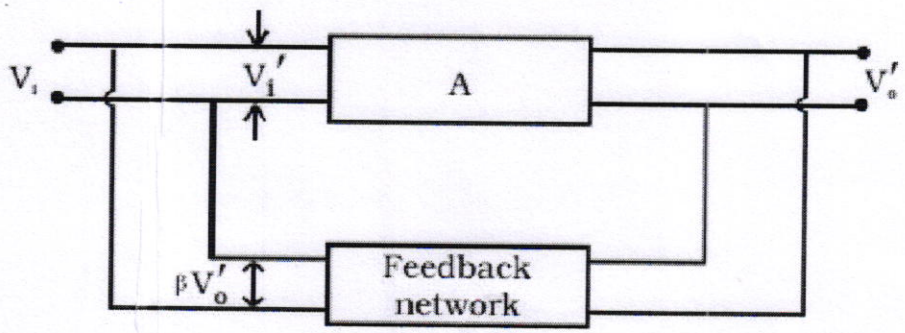

Fig Feedback amplifier

⇨ The output injected back may aid or oppose the input signal & on this basis feedback can be of two types:

1.**Positive or regenerative feedback**
2.**Negative or degenerative feedback**

1- **Positive or regenerative feedback :** When the fraction of output injected back is in phase with the input signal & aids with it, it is called **positive or regenerative** feedback.

Adv: Overall gain of amplifier is increased.
Disadvantage: 1- Increased Noise & distortion in output.
2- Results in poor stability
Application: In Oscillator circuits .

2.**Negative or degenerative feedback :** In case the fraction of output injected back is in opposition or 180^0 out of phase with input signal, it is known as negative or degenerative feedback.

Adv:1- Decreased Noise & distortion in output.
2- Improved stability
Disadvantage: 1- Overall gain of amplifier is decreased.
Application: widely used in amplifier circuits .

⇨ **Types Of Feedback on the basis of Electrical Quantity:**
On this Basis the feedback can be classified as below:
1- Voltage Feedback
2- Current feedback
⇨ Both voltage or current can be fed back to input either in series or in shunt.
⇨ Where series feedback connections generally increase input impedance, the shunt feedback connections tend to decrease input impedance.
⇨On other hand voltage feedback decreases output impedance whereas current feedback decreases output impedance.

B- Derivation of expression for gain of an amplifier employing feedback:

⇨ Let V_1 be input to amplifier & V_0 be output of the amplifier Without feedback. In This Condition Voltage Gain A_v Of this amplifier will be given as

$$A_v = V_0 / V_1$$

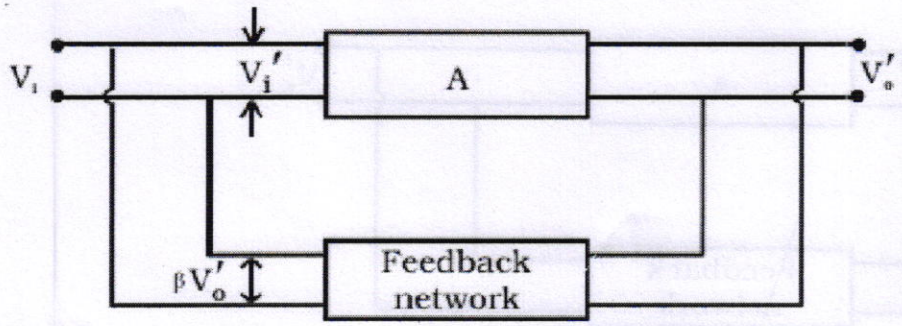

Fig Feedback amplifier

Calculation of gain with feedback

⇨ When a feedback network is employed than the new input to the amplifier is

$$V_1' = V_1 \pm \beta V_0$$

($V_1' = V_1 + \beta V_0$ for Positive Feedback & $V_1' = V_1 - \beta V_0$ For negative feedback)

Where β is factor of feedback circuit, the value of which depends on the type of feedback network used.

⇨ Value of $\beta<1$ when the feedback network consists of passive components only & $\beta>1$ if there are active components in the feedback network .

⇨ Let us consider calculation og gain for a negative feedback amplifier. For such an amplifier, new input value will be

$$V_1' = V_1 - \beta V_0$$

⇨ Now Gain of this amplifier will be $A_v = V_0 / V_1' = V_0 / V_1 - \beta V_0$

or alternatively $A_v \times (V_1 - \beta V_0) = V_0$

or $A_v \times V_1 - A_v \times \beta V_0 = V_0$

or $A_v \times V_1 = (V_0 + A_v \times \beta V_0) = V_0 (1 + \beta A_v)$

or $A_v / (1 + \beta A_v) = V_0 / V_1 = A_v'$

Where A_v' is the gain of amplifier with negative feedback

Similarly gain for an amplifier with positive feedback can be calculated & that comes out to be

$$A_v' = A_v / (1 - \beta A_v)$$

⇨ The expression for gain with feedback shows that the gain is affected after using feedback circuit.