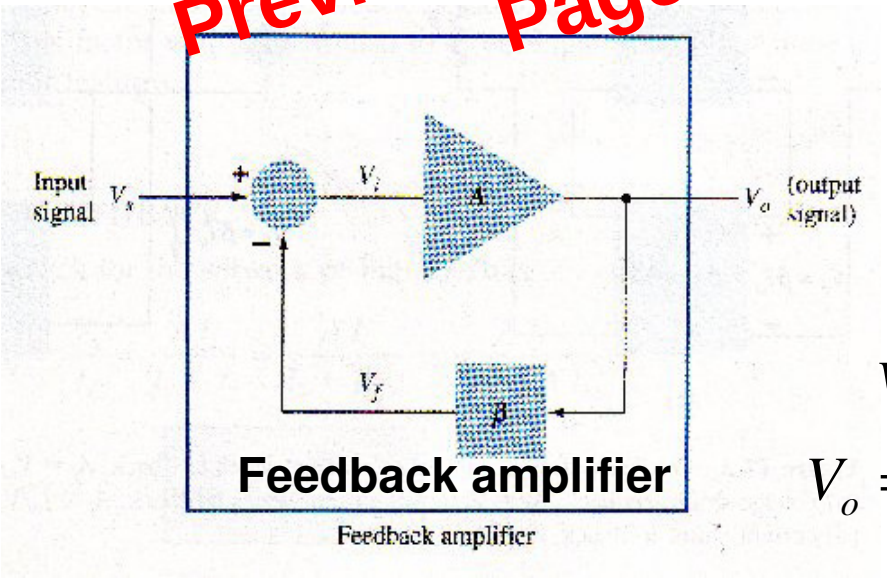
Feedback

- Both negative feedback and positive feedback are used in amplifier circuits.

- Negative feedback returns part of the output to oppose the input, whereas in positive feedback the feedback signal aids the input signal.



If $V_f = 0$ (there is no feedback)

$$A = \frac{V_o}{V_S} = \frac{V_o}{V_i}$$

If feedback signal V_f is connected in series with the input, then $V_i = V_S - V_f$

$$V_o = AV_i = A(V_s - V_f) \quad \text{But} \quad V_f = \beta V_o$$

$$V_o = A(V_s - \beta V_o) \qquad \boxed{V_o(1+\beta A) = AV_s}$$

A_f : closed-loop gain of the amplifier
A: Open-loop gain of the amplifier gain

$$\boxed{A_f = \frac{V_o}{V_s} = \frac{A}{(1+\beta A)}}$$

Basic Feedback Topologies

➢ **Depending on the input signal (voltage or current) to be amplified and form of the output (voltage or current), amplifiers can be classified into four categories. Depending on the amplifier category, one of four types of feedback structures should be used.**

- **Voltage series feedback** ($A_f = V_o/V_s$) – *Voltage amplifier*
- **Voltage shunt feedback** ($A_f = V_o/I_s$) – *Trans-resistance amplifier*
- **Current series feedback** ($A_f = I_o/V_s$) **-** *Trans-conductance amplifier*
- **Current shunt feedback** ($A_f = I_o/I_s$) - Current amplifier

➢ **Here voltage refers to connecting the output voltage as input to the feedback network. Similarly current refers to connecting the output current as input to the feedback network.**

➢**Series refers to connecting the feedback signal in series with the input voltage; Shunt refers to connecting the feedback signal in shunt (parallel) with an input current source.**