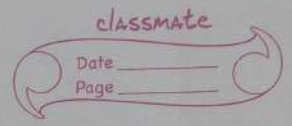


Course: B.Sc (Hons) PHYSICS

PAPER: Analog Systems & Applications
(code: 32221403)

Semester: IV Section: A

Name of Teacher: Dr. V.K. Paliwal

Types of Negative Feedback

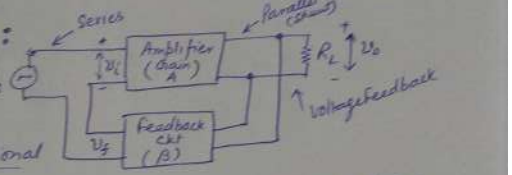
Two Main Types: → Negative Voltage Feedback
→ Negative Current Feedback

Negative Voltage Feedback → Voltage-Series Feedback
→ Voltage-Shunt Feedback

Negative Current Feedback → Current-Series Feedback
→ Current-Shunt Feedback

Total 4 Types of Neg Feedback

(1) Voltage-Series Feedback:

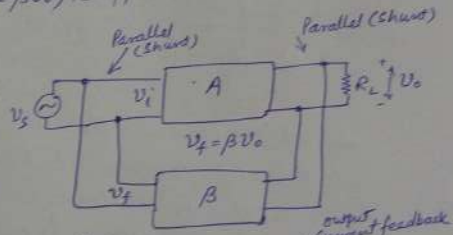


⇒ $v_f = \beta v_o$

(*) ⇒ Voltage Feedback to the Input Section of Amplifier is proportional to the Output Voltage (v_o).

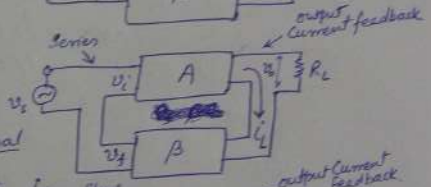
⇒ A Fraction of output voltage ($= \beta v_o$) is applied in Series with input voltage v_s.

(2) Voltage-Shunt Feedback:



⇒ Now a fraction of output voltage ($= \beta v_o$) is applied in Parallel (Shunt) with Input voltage v_s.

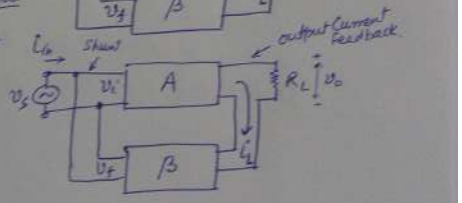
(3) Current-Series Feedback:



(*) ⇒ Voltage Feedback to the Input Section of Amplifier is proportional to the Output Current (i_L).

⇒ Voltage Feedback is applied in Series to input

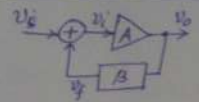
(4) Current-Shunt Feedback:



⇒ Voltage Feedback is applied parallel to the input voltage.

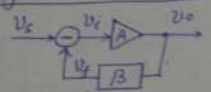
Advantages/Disadvantages of Feedback

Positive Feedback: In this case the feedback, i.e the part of output signal (voltage or current), is in phase (0°) with the input signal and hence enhances/increases it.



- It 'Increases' the Gain (A_{fp}) of the Amplifier.
- However, it also increases Distortion (Noise) in ckt.
- Increases Instability in the ckt.
- Used in 'Oscillator Circuits'.
- It is also called 'Regenerative Feedback'.

Negative Feedback: In this case the feedback part (voltage/current) is out of Phase (180° differena) with input signal & hence reduces/decreases it.



- It "Decreases" the Gain (A_{fn}) of the Amplifier, but Gain is Stabilized
- But "Distortion" is Reduced — (Harmonic or Nonlinear Distortion)
- "Noise" is Reduced
- Input Impedance/Resistance is Increased.
- Output Impedance/Resistance is Decreased.
- Operating Point is Stabilized.
- Used in a wide range of applications:
  - Amplifiers, Regulated Power Supply etc.
- It is also called 'Degenerative Feedback'.

How Gain (A) is affected in Feedback?

Negative Feedback: The gain (A) (Gain without feedback) is given as the ratio of output voltage (V_o) to the input volt (V_i)

So $A_{neg} = \frac{V_o}{V_i} = \frac{V_o}{(V_s - \beta V_o)}$

$\Rightarrow A_{neg}(V_s - \beta V_o) = V_o$

$\Rightarrow A_{neg} V_s = V_o(1 + \beta A)$

$\Rightarrow \boxed{\frac{V_o}{V_s} = \frac{A}{(1+\beta A)}} = A_{fn}$ (overall gain with the Negative Feedback of Amplifier)

So $\boxed{A_{fn} = \text{Gain with Negative Feedback} = \frac{A}{(1+\beta A)}}$ & $\boxed{A_{fn} < A}$ $\because (1+\beta A) > 1$

(*) $\Rightarrow$ So Negative Feedback reduces/decreases the Gain of the Amplifier ckt.

Positive Feedback: Again $A = \frac{V_o}{V_i} = \frac{V_o}{(V_s + \beta V_o)}$

$\Rightarrow A(V_s + \beta V_o) = V_o \Rightarrow A V_s = V_o(1 - \beta A)$

$\Rightarrow \boxed{\frac{V_o}{V_s} = \frac{A}{(1-\beta A)} = A_{fp}}$ = Gain with Positive Feedback

Since $(1 - \beta A) < 1$ so $\Rightarrow$ ~~$A_{fp} < A$~~ $\boxed{A_{fp} > A}$

i.e (*) $\Rightarrow$ Positive feedback Increases the Gain of the Amplifier ckt.

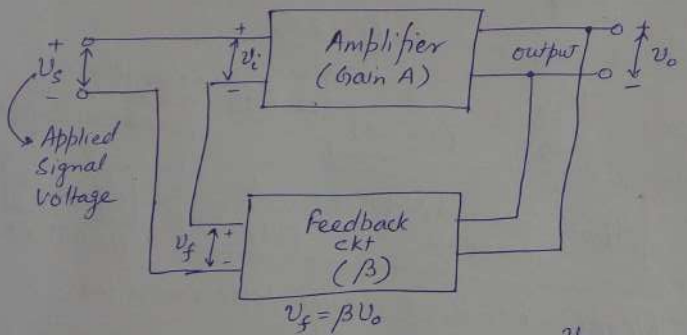
Dated: 16.03.2020

UNIT 5

FEEDBACK IN AMPLIFIERS [4 Lectures]

⇒ An Amplifier circuit amplifies (increases) signal strength (Not only information but also noise)

Principle of Feedback in Amplifier



$v_f = \beta v_o$

A = Gain of the Amplifier ckt $= \frac{v_o}{v_i}$

⇒ Feedback network provides a fraction of output as the feedback voltage to the input section of Amplifier ckt

So $v_f = \beta v_o$, $\beta < 1$ (Called "Feedback Ratio/Fraction)

Positive Feedback: $v_i = v_s + v_f = v_s + \beta v_o$

Negative Feedback: $v_i = v_s - v_f = v_s - \beta v_o$