Bhartiya Vidya Bhavan's Shri Ishvarlal L. P. Arts-Science and J. Shah Commerce College, Dakor
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B.Sc. (semester -3)

Subject : Physics

Course : USO3CPHY22

BASIC SOLID STATE ELECTRONICS

UNIT 3: FEEDBACK IN AMPLIFIERS

Lecture 2

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- Quick Revision of Lecture 1

- How negative feedback is Advantageous

- Voltage gain of Series Voltage Negative feedback Amplifier

- Stabilization Of GAIN

- ***<u>Quick Revision of Lecture 1</u>***
- Feedback is the process of taking part of output signal and feeding it back to the input circuit
- <u>two types of feedback</u> (1) Negative feedback (2) Positive feedback
- When the feedback signal is out of phase with the input signal and thus opposes it, it is called negative feedback
- When the feedback signal is in phase with the input signal and thus aids it, it is called positive feedback.
- <u>Amplifier negative feedback types</u>
- If the feedback network samples the output voltage, it is *voltage feedback*.
- If it samples the output current, it is *current feedback*.
- The feedback signal can be connected in <u>series</u> or in <u>parallel</u> with the signal source and the amplifier input terminals,
- so called *SERIES FEEDBACK* and SHUNT or *PARALLEL FEEDBACK*.

❖ ***Quick Revision of Lecture 1***

- there are FOUR types of negative feedback in amplifier circuits:
  - Series voltage feedback
  - Series current feedback
  - Shunt or Parallel voltage feedback
  - Shunt or Parallel current feedback

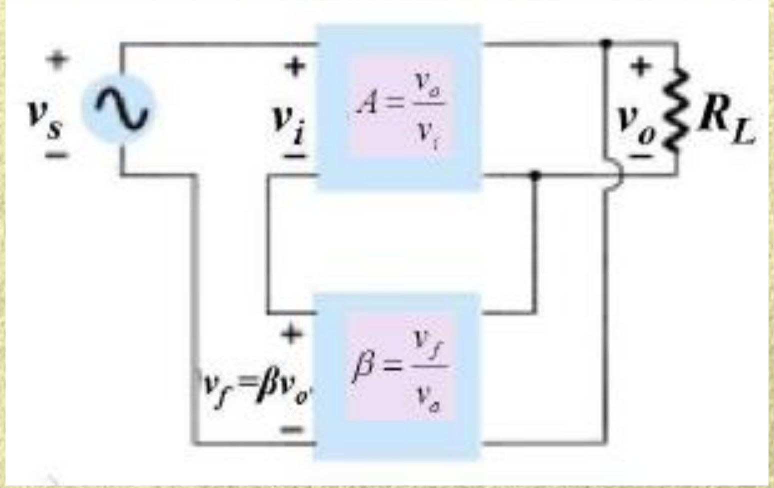
  - In **voltage feedback,** the input terminals of the feedback network are in parallel with the load, and the output voltage appears at the input terminals of the feedback block.
  - Whereas in ***current feedback,*** the input terminals of the feedback network are in series with the load, and the load current flows through the input of the feedback block.

- A Series feedback tends to increase the input impedance of the amplifier..
- Shunt or Parallel feedback tends to decrease the input impedance of the amplifier..
- A Voltage feedback tends to decrease the output impedance of the amplifier...
- Current feedback tends to decrease the output impedance of the amplifier...
- Most of the amplifier demands higher input impedance and lower output impedance
- which are both met in Series Voltage Feedback Amplifier...so...they widely used....

❖ *HOW NEGATIVE FEEDBACK IS ADVANTAGEOUS*?

- The negative feedback in amplifiers reduces the gain.
- However, il improves the performance of amplifier in several ways as shown below:-
- (i) It improves the stability of amplifier gain
- (ii) It reduces the distortion and noise.
- (iii) It increases the input impedance.
- (iv) It decreases the output impedance
- (v) It increases the bandwidth.

❖ Voltage gain of Series Voltage Negative feedback Amplifier



- Here, a portion of output voltage feedback in series to the input.
- Negative feedback results overall gain reduction.
- If there is no feedback (V_f = 0).The voltage gain of the amplifier is:-

$$A = \frac{v_o}{v_s} = \frac{v_o}{v_i}$$

If V_f is connected in series with the input, then ….

$V_i = V_s - V_f$ Since $V_o = AV_i = A\left(V_s - V_f\right)$ = AV_s – AV_f…= AV_s – A(βV_o)

=> V_o (1+ βA) = AV_s…. $\therefore \frac{\boldsymbol{V_o}}{\boldsymbol{V_s}} = \frac{\boldsymbol{A}}{1+\beta A}$

So overall voltage gain with feedback is $A_f = \frac{v_o}{v_s} = \frac{A}{1+\beta A}$

- In case of Positive feedback then above equation assumes in below form

$$A_f = \frac{A}{1 - A\beta}$$

- From above equation we can say that in case of Negative feedback

the Voltage gain of amplifier Decreases … However it is desirable for Good

performance…….

- From above equation we can say that in case of Positive feedback

.

the Voltage gain of amplifier Increases … This type of feedback is used in

Oscillator circuits……

❖ ***STABILIZATION OF GAIN***

- The gain of negative feedback amplifier is given by equation $A_f = \frac{A}{1+A\beta}$ ..(1)
- Here if we make $A\beta >>> 1$ then $A_f = \frac{A}{A\beta} = \frac{1}{\beta}$ ...(2)
- then A_f becomes independent of internal gain A.
- to estimate small change in the gain of amplifier we differentiate equ (1) with respect to A… so we get
- $\frac{dA_f}{dA} = \frac{1}{(1+A\beta)^2}$

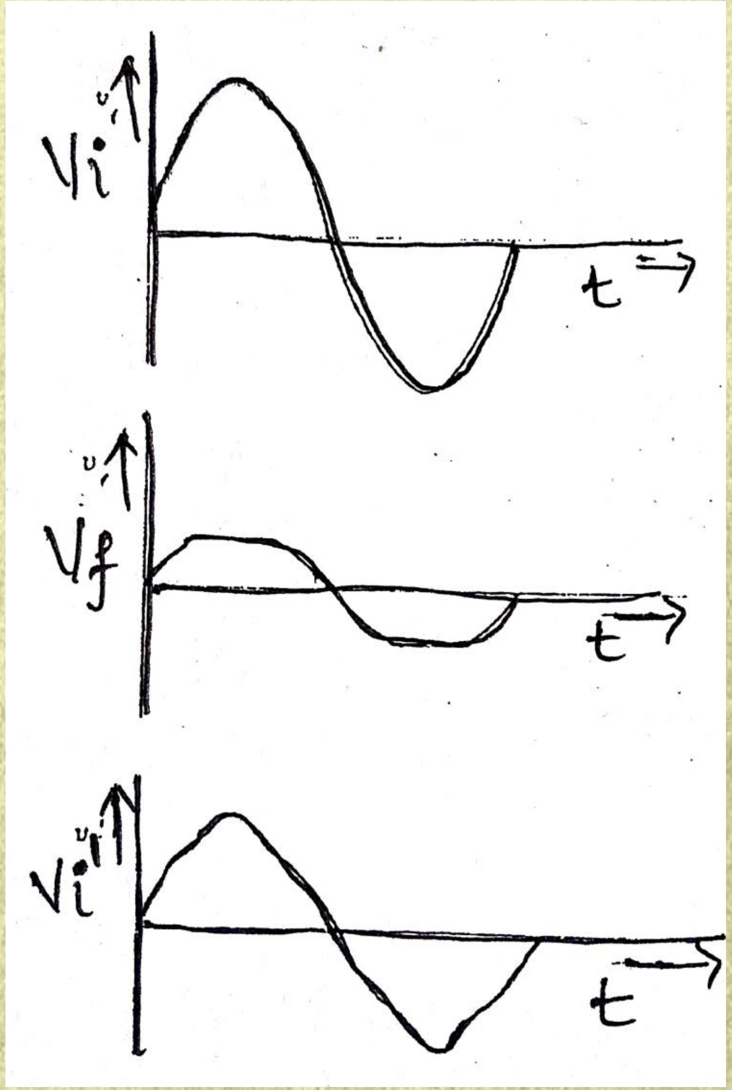
- $\therefore\ dA_f = \frac{dA}{(1+A\beta)^2}$ …(3)

- Dividing equ (3) by equ (1), we get

- $\frac{dA_f}{A_f} = \frac{dA}{(1+A\beta)^2} \text{ X } \frac{1+A\beta}{A}$ $\therefore \frac{dA_f}{A_f} = \frac{1}{1+A\beta} \text{ X } \frac{dA}{A}$ ……(4)

- Here since $(1+A\beta) >>> 1$, the percentage change in A_f is very much less than the percentage change in A…

❖ *Reduction in Distortion and Noise*



- The figure shows the voltage waveforms corresponding to the input voltage V_i, the feedback voltage V_f and the net input voltage to the amplifier vi' in case of a negative feedback amplifier..
- The voltage V_f gets subtracted from the input voltage V_i to make the net input V_i ' to the amplifier,
- Actually when input voltage vi is amplified by the amplifier, its peak is flattened and it remains flattened even after it passes through the feedback network and becomes V_f.
- This V_f is then subtracted from V_i and gives the resulting output V_i ' with more higher peak
  Thus every time input is predistorted to compensate for the flattening caused by the amplifier.

- IN NEXT LECTURE WE TALK MORE ABOUT REMAINING ADVANTAGE OF NEGETIVE FEEDBACK AMPLIFIER

- PLEASE TRY TO LEARN FROM BOTH LECTURES

- AND MAKE NOTES

THANK YOU…..