of closure will be -20 dB/decade throughout as shown in fig. The pole of $f_0$should be selected so that -20 dB/decade fall should meet the 0dB line at f_2 which is the second pole of A_{0L}.

1.11 Example with Solutions

Example 1: A feedback amplifier has an open loop gain of 600 and feedback factor $\beta = 0.01$. Find the closed loop gain with negative feedback.

Solution:

$$A_{Vf} = \frac{A}{1+\beta A} = \frac{600}{1+600\times 0.01}$$
$$= 85.714$$

Example 2: If an amplifier has a bandwidth of 300 KHz and voltage gain of 100, what will be the new bandwidth and gain if 70% negative feedback is introduced? What will be the gain bandwidth product before and after feedback? What should be the amount of feedback if the bandwidth is to be limited to 800KHZ?

Solution:

The voltage gain of the amplifier with feedback is given as,

$$A_{Vf} = \frac{A}{1+\beta A}\ where\ \beta = 0.1\ and\ A = 100$$
$$A_{Vf} = \frac{100}{1+100\times 0.1}$$
$$= 9.09$$

The bandwidth of an amplifier with feedback is given by,

$$B_{Wf} = (1+A_{mid}\beta)f_H - \frac{f_L}{(1+A_{mid}\beta)}$$

Assuming $f_H \gg f_L$ we have,

$$B_W = f_H\ and\ B_{Wf} = (1+A_{mid}\beta)B_W$$
$$B_{Wf} = (1+100\times 0.1)\times 300kHz$$
$$= 3300KHz$$

The gain bandwidth product before feedback is,

$$\text{Gain bandwith product} = A_V B_W$$
$$= 100\times 300K = 30\times 10^6$$

The gain bandwidth product after feedback is,

$$= A_{Vf}\times B_{Wf}$$
$$= 9.09\times 3300KHz$$
$$= 30\times 10^6$$

If bandwidth is to be limited to 600 kHz we have $f_{Hf} = 800KHz$ assuming $f_{Hf} \gg f_{Lf}$

We know that,

$$B_{Wf} = (1+A_{Vmid}\beta)f_H$$
$$800K = (1+100\beta)300K$$
$$\beta = \frac{\frac{800}{300}-1}{100} = 0.01667$$

1.12 Two Marks Question and Answers

1. What is meant by feedback?

   A portion of the output signal is taken from the output of the amplifier and is combined with the normal input signal. This is known as feedback.

   (OR)

   Feedback is a part of output is sampled and fedback to the input of the amplifier.

2. Give the different types of feedbacks used in amplifier circuits.
   a) Positive feedback
   b) Negative feedback.
3. Define the positive feedback.

   When input signal and part of the output signal are in phase, the feedback is called Positive feedback.

4. Define negative feedback.

   When input signal and part of the output signal are in out of phase, the feedback is called negative feedback.

5. What type of feedback is used in oscillator?

   Positive.

6. Give classification of amplifiers.

   The amplifiers can be classified into four broad categories: voltage, current, Tranconductance and Tranresistance amplifiers.

7. What is node sampling?

   When the output voltage is sampled by connecting the feedback network in shunt across the output, the connection is referred to as voltage or node sampling.

8. What is loop sampling?

   When the output current is sampled by connecting the feedback network in series with the output, the connection is referred to as current or loop sampling.

9. Define feedback factor or feedback ratio.

   The ratio of the feedback voltage to output voltage is known as feedback factor or feedback ratio.

10. What is the purpose of mixer network in feedback amplifier?

    The mixer network is used to combine feedback signal and input at input of an amplifier.

11. What are the advantages of introducing negative feedback?
    i. Input resistance is very high. Output resistance is low.
    ii. The transfer gain A_f of the amplifier with feedback can be stabilized against Variations of the h-parameters or hybrid π parameters of the transistors or the Parameters of the others active devices used in the amplifiers.
    iii. It improves the frequency response of the amplifiers.

iv. There is a significant improvement in the linearity of operation of the feedback.

12. List the four basic feedback topologies.
    a. Voltage amplifier with voltage series feedback.
    b. Transconductance amplifier with current-series feedback.
    c. Current amplifier with current-shunt feedback.
    d. Transresistance amplifier with voltage shunt feedback.
13. Give the expression for gain of an amplifier with feedback.

    $A_{Vf} = 1/(1+\beta A)$

    Where, A_{Vf} – feedback voltage gain. A_V– Voltage gain.

    β - Feedback factor
14. What is loop gain or return ratio.

    A path of a signal from input terminals through basic amplifier, through the feedback network and back to the input terminals forms a loop. The gain of this loop is the product -A β . This gain is known as loop gain or return ratio.
15. What is sensitivity of the transfer gain?

    The fractional change in amplification with feedback divided by the fractional change without feedback is called the sensitivity of the transfer gain.
16. What is desensitivity?

    The reciprocal of the sensitivity is called the desensitivity D. it is given as $D = 1 + A\beta$.
17. What is the effect of lower cut-off frequency with negative feedback?

    Lower cutoff frequency with feedback is less than lower cutoff frequency without feedback by factor $(1 + \text{Amid}\ \beta)$
18. What is the effect of upper cut-off frequency with negative feedback?

    Upper cutoff frequency with feedback is greater than upper cutoff frequency without feedback by factor $(1 + \text{Amid}\ \beta)$
19. What is the effect of negative feedback on bandwidth?

    Bandwidth of amplifier with feedback is greater than bandwidth of amplifier without feedback.
20. Why gain bandwidth product remains constant with the introduction of negative feedback?

    Since bandwidth with negative feedback increases by factor $(1 + A\beta)$ and gain decreases by same factor, the gain-bandwidth product of an amplifier does not altered, when negative feedback is introduced.
21. What is the effect of negative feedback on feedback distortion?

    The frequency distortion is reduced with the negative feedback.
22. What is the effect of negative feedback on noise?

    The noise is reduced with the negative feedback.
23. What is the effect of negative feedback on nonlinear distortion?

    The linear distortion is reduced with the negative feedback.

24. What are the types of distortions in an amplifier?
    i. Frequency
    ii. Noise and non linear
25. What type of feedback is employed in emitter follower amplifier?

    Voltage series feedback.
26. The distortion in an amplifier is found to be 3%, when the feedback ratio of negative feedback amplifier is 0.04. When the feedback is removed, the distortion becomes 15%. Find the open and closed loop gain.

    Solution:

    Given: $\beta = 0.04$

    Distortion with feedback = 3%,

    Distortion without feedback = 15%

    D = 15/3 = 5.

    Where $D = 1+A\beta = 5$

    A = 100.
27. Which is the most commonly used feedback arrangement in cascaded amplifiers and why?

    Voltage series feedback is the most commonly used feedback arrangement in cascaded amplifiers. Voltage series feedback increases input resistance and decreases output resistance. Increase in input resistance reduces the loading effect of previous stage and the decrease in output resistance reduces the loading effect of amplifier itself for driving the next stage.
28. State the nyquist criterion for stability of feedback amplifiers?
    a. The amplifier is unstable if the curve does not encloses the point -1+j0. The system is called as unstable system.
    b. The amplifier is stable if the curve encloses the point -1+jo. That system is called as stable system.
29. What is nyquist diagram?

    The plot which shows the relationship between gain and phase-shift as a function of frequency is called as nyquist diagram.