Problem: An Amplifier has an openloop gain of 1000 and a feedback ratio of 0.04. If the open loop gain changes by 10% due to temperature, find the percentage change in gain of the amplifier with feedback.

solution:- Given $A = 1000$, $\beta = 0.04$ and $\frac{dA}{A} = 10$

we know that the percentage change in gain of the amplifier with feedback is

$$\frac{dA_f}{A_f} = \frac{dA}{A}\frac{1}{(1+A\beta)} = 10 \times \frac{1}{1+(1000 \times 0.04)} = 0.25\%$$

Problem: An Amplifier has voltage gain with feedback is 100. If the gain without feedback changes by 20% and the gain with feedback should not vary more than 2%, determine the values of open loop gain A and feedback ratio β.

Solution: Given $A_f = 100$, $\frac{dA_f}{A_f} = 2\% = 0.02$ and $\frac{dA}{A} = 20\% = 0.2$

we know that

$$\frac{dA_f}{A_f} = \frac{dA}{A}\frac{1}{1+A\beta} \Rightarrow 2 = 20\frac{1}{1+A\beta}$$

$$\Rightarrow 1+A\beta = 10$$

the gain with feedback is $A_f = \frac{A}{1+A\beta}$

$$\Rightarrow 100 = \frac{A}{10} \Rightarrow A = 1000$$

$$1+A\beta = 10 \Rightarrow \beta = \frac{9}{1000} = 0.009.$$

Problem: An Amplifier has a midband gain of 125 and a bandwidth of 250 KHz (a) If 4% negative feedback is introduced. find the new bandwidth and gain.
(b) If the bandwidth is to be restricted to 1 MHz, find the feedback ratio.

Solution: Given $A = 125$, $BW = 250$ KHz and $\beta = 4\% = 0.04$

we know that $B.W_f = (1+A\beta)\,B.W$

$$B.W_f = (1 + (125 \times 0.04)) \times 250 \times 10^3$$

$$BW_f = 1.5 MHz$$

Gain with feedback $A_f = \frac{A}{1+A\beta} = \frac{125}{1+(125 \times 0.04)} = 20.83$

(b) $BW_f = (1+A\beta) BW$

$$1 \times 10^6 = (1 + 125 \beta') \times 250 \times 10^3$$

$$1 + 125\beta' = 4 \Rightarrow \beta' = \frac{3}{125} = 0.024 = 2.4\%$$

Problem: An Amplifier has a Voltage gain of 400, $f_1 = 50 Hz$, $f_2 = 200 KHz$, and a distortion of 10% without feedback. Determine the amplifier voltage gain f_{1f}, f_{2f} and D_f when a negative feedback is applied with feedback ratio of 0.01.

Solution: Given $A = 400$, $f_1 = 50 Hz$, $f_2 = 200 KHz$, $D = 10\%$ and $\beta = 0.01$

We know that voltage gain with feedback

$$A_f = \frac{A}{1+A\beta} = \frac{400}{1+(400 \times 0.01)} = 80$$

New Lower 3dB frequency

$$f_{1f} = \frac{f_1}{1+A\beta} = \frac{50}{1+(400 \times 0.01)} = 10 Hz$$

New Upper 3dB frequency

$$f_{2f} = (1+A\beta) \times f_2$$

$$f_{2f} = (1 + 400 \times 0.01) \times 200 \times 10^3 = 1 MHz$$

Distortion with feedback

$$D_f = \frac{D}{1+A\beta} \Rightarrow D_f = \frac{10}{5} = 2\%$$