FEEDBACK AMPLIFIERS

(III & IV) Tutorial

An amplifier has a voltage gain of 40. The amplifier is now modified to provide a 10% negative feedback in series with the input. Calculate (i) Voltage gain with feedback (ii) amount of feedback in dB (iii) loop gain.

Openloop voltage gain, $A = 40$

Feed back ratio $\beta = 10\%$ or 0.1.

(i) voltage gain with feedback

$$A_f = \frac{A}{1+\beta A} = \frac{40}{1+0.1\times 40} = 8$$

(ii) Amount of feedback in dB

$$= 20\log_{10}\left|\frac{1}{1+\beta A}\right| = 20\log_{10}\left|\frac{1}{1+40\times 0.1}\right|$$

$$= 20\log_{10} 0.2 = -13.98$$

(iii) loop gain $= AB = 40\times 0.1 = 4$

(2) An amplifier has a mid-frequency gain of 100 and a bandwidth of 200kHz

(i) What will be the new bandwidth and gain, if 5% negative feedback is introduced?

(ii) what should be the amount of feedback, if the bandwidth is to be restricted to 1MHz

Mid-frequency gain $A = 100$

Bandwidth without feedback, $BW = 200\,kHz$

Feed back ratio, $\beta = 5\% = 0.05$

(1) Bandwidth with feedback

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

$$= (1+0.05 \times 100) \times 200\,kHz = 1200\,kHz \text{ @ } 1.2\,MHz$$

Gain with feedback

$$A_f = \frac{A}{1+\beta A} = \frac{100}{1+0.05 \times 100} = 16.67$$

Feedback ratio to restrict the bandwidth to 1 MHz @ 1000k

$$\beta = \frac{\frac{BW_f}{BW} - 1}{A} = \frac{\frac{1000}{200} - 1}{100}$$

$$= 0.04 \text{ or } 4\%$$