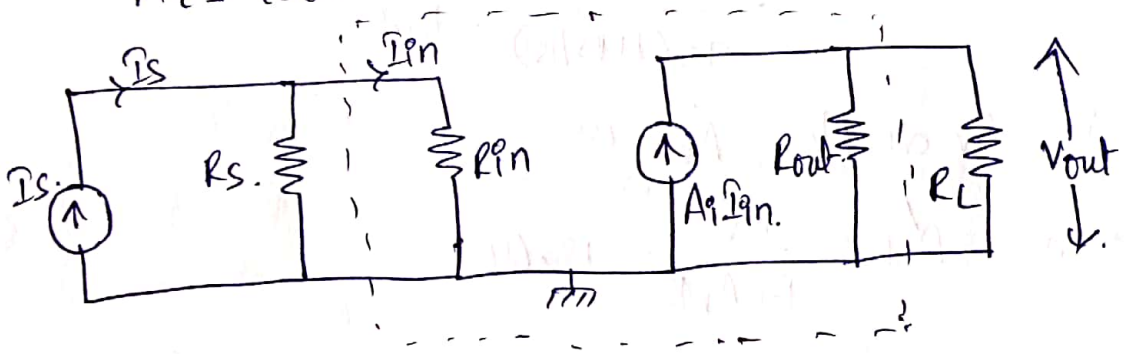
Tutorial 4/1/19.

(1) A current Amplifier has an i/p resistance of 10Ω, and an o/p resistance of 10kΩ and a current gain of 1000. It is fed by a current source having a source resistance of 10kΩ and its o/p is connected to a 10Ω load resistance. Find the voltage gain and power gain.

Sol $R_s = 10K\Omega$, $R_{in} = 10\Omega$, $R_{out} = 10K\Omega$, $R_L = 10\Omega$.

$A_i = 1000$.



i/p voltage $V_{in} = I_{in} R_{in} = 10 . I_{in} . V.$

o/p voltage $V_{out} = A_i I_{in} (R_{out} \| R_L) = A_i I_{in} \cdot \frac{R_{out} \times R_L}{R_{out} + R_L}$

$= 1000 I_{in} \cdot \frac{10K \times 10}{10K + 10} = 9,990 I_{in} V.$

$A_V = \frac{V_{out}}{V_{in}} = \frac{9990 I_{in}}{10 I_{in}} = 999.$

The current gain $A_I = \frac{I_L}{I_C} = \frac{\frac{V_{out}}{R_L}}{I_{in}\left(\frac{R_s + R_{in}}{R_s}\right)} = \frac{9990 I_{in}}{10\left(\frac{10K+10}{10K}\right) \cdot I_{in}}$

$A_I = 998.$

power gain $A_p = A_V . A_I = 997 \times 10^3.$

(2) Calculate the gain of a negative feedback amplifier with an internal gain $A_v = 75$ and feedback fraction $m_v = 1/15$. What will be the gain if A_v doubles?

Sol

open loop voltage gain $A_v = 75$.

feedback fraction $\beta = \frac{1}{75}$

negative feedback voltage gain $A_f = \frac{A_v}{1 + A_v \cdot \beta}$

$= \frac{1}{75(1+75/15)} = 12.5$.

If A_v doubles $A_v' = 150$.

Then $A_f' = \frac{A_v'}{1 + A_v' \beta} = 13.64$.

(3). An amplifier has a voltage gain of 40. The amplifier is now modified to provide a 10% negative feedback in series with the i/p. Find (i) voltage gain with feedback (ii) amount of feedback in dB, (iii) loop gain.

Sol.

$A = 40$

feedback $10\% = 0.1$

$A_f = \frac{A}{1 + \beta A} = 8$.

Amount of feedback $= \frac{1}{1 + A\beta}$

in dB $= 20 \log \left(\frac{1}{1 + A\beta}\right) = -13.98$

loop gain $= A\beta = 40 \times 0.1 = 4$.

(9) The voltage gain of an amplifier without feedback is 2500. If 40dB of negative feedback is added. find
(i) A_f.
(ii) for obtaining the same o/p, how much must be the i/p increased.

Sol. $A = 2500$.

Desensitivity of transfer gain $= (1+A\beta)$

$= \text{antilog}\left(\frac{40}{20}\right) = 100.$

$A_f = \frac{2500}{100} = 25.$

The i/p for same o/p will become A/A_f times the i/p without feedback ie $\frac{2500}{25} = 100$ times the i/p without feedback.