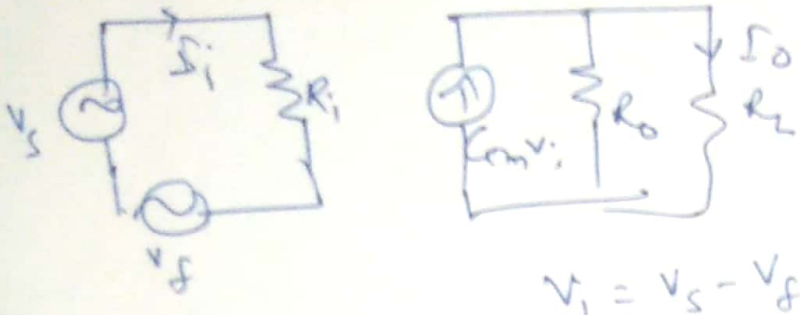
Current- series feedback (Input Resistance)



For current- series

$\beta I_o = V_f$

$V_i = V_s - V_f$ or $V_s = V_i + V_f$

$V_s = I_i R_i + V_f \Rightarrow I_i R_i + \beta I_o$ —— (1)

from o/p loop I_o is o/p current- at- load resistor R_L

Using current- dividing N/W at- o/p

$$I_o = \frac{G_m V_i \, R_o}{R_o + R_L} \Rightarrow \frac{I_o}{V_i} = \boxed{\frac{G_m R_o}{R_o + R_L}}$$

$$I_o = V_i G_M \qquad G_M$$

Substitute in (1)

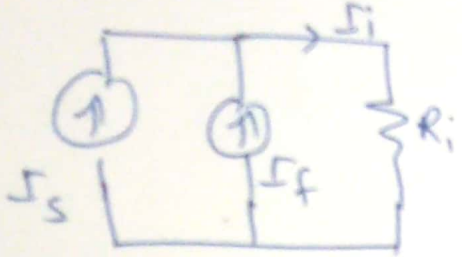
$$V_s = I_i R_i + \beta G_M V_i \Rightarrow I_i R_i + \beta G_M I_i R_i$$

$$V_s = I_i R_i (1 + \beta G_M)$$

$$\frac{V_s}{I_i} = R_i (1 + \beta G_M)$$

$$R_{if} = R_i (1 + \beta G_M)$$

Voltage shunt- feedback



$I_f = \beta V_o$

$I_s = I_i + I_f$

$\Rightarrow I_i + \beta V_o$

$V_o = \dfrac{R_m I_i \; R_o}{R_o + R_L}$

$\dfrac{V_o}{I_i} = \boxed{\dfrac{R_m R_o}{R_o + R_L}}$

$\downarrow$

R_M

$I_s = I_i + \beta I_i R_M$

$V_o = I_i R_M$

$I_s = I_i (1 + \beta R_M)$ — (1)

$R_{if} = \dfrac{V_i}{I_s}$ $\quad \therefore \quad \dfrac{V_i}{I_s} = \dfrac{V_i}{I_i (1 + \beta R_M)}$

$R_{if} = \dfrac{R_i}{1 + \beta R_M}$