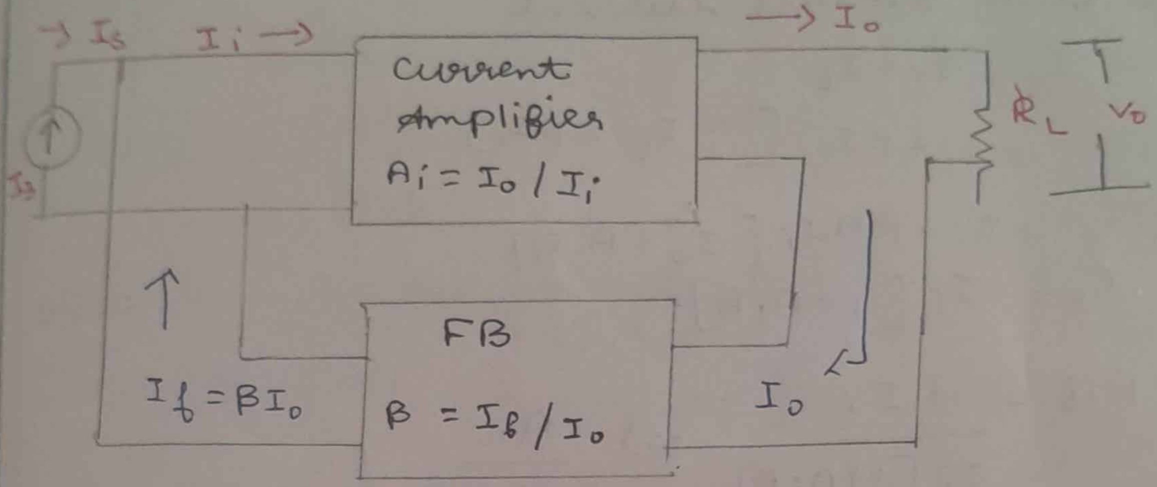
SHUNT SERIES FEEDBACK AMPLIFIER

I/P : current (I_i)

O/P : current (I_o)

FB : current (I_f)



$I_o \propto I_i$, $I_o = A_i I_i$

$$A_i = \frac{I_o}{I_i}$$

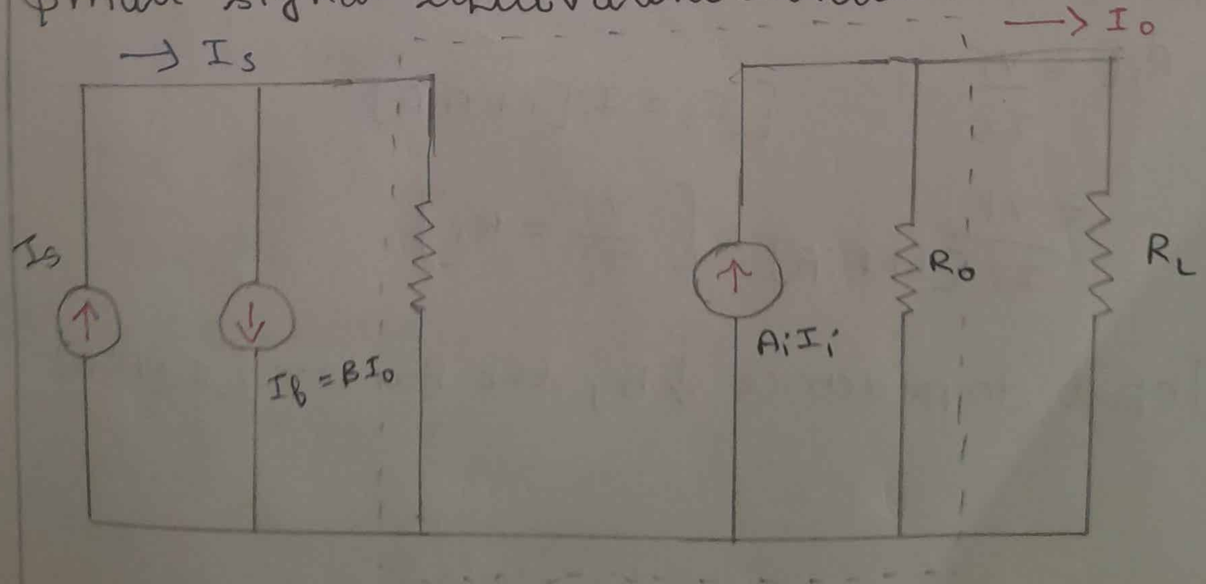
It is act as the current amplifier.

condition

Input impedance is low

output impedance is high

small signal equivalent circuit.



Gain of FB amplifier

without FB

$$A_i = \frac{I_o}{I_i}$$

with FB

$$A_{if} = \frac{I_o}{I_s}$$

To find source current

$$I_s = I_i + I_f$$

$$= I_i + \beta I_o \quad [\because I_f = \beta I_o]$$

$$= I_i + \beta A_i I_i \quad [I_o = A_i I_i]$$

$$I_s = I_i[1 + A_i\beta]$$

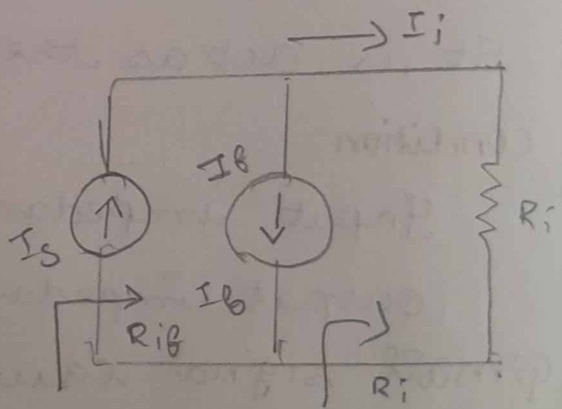
$$A_{if} = \frac{A_i I_i}{I_i[1+A_i\beta]} \Rightarrow \frac{A_i}{1+A_i\beta}$$

The gain is ↓ ces by the factor $(1+A_i\beta)$ there by increasing in the stability.

Input Impedance

without feedback

$$R_i = \frac{V_i}{I_i}$$



with feedback

$$R_{if} = \frac{V_i}{I_s} \quad [I_s = I_i[1+A_i\beta]]$$

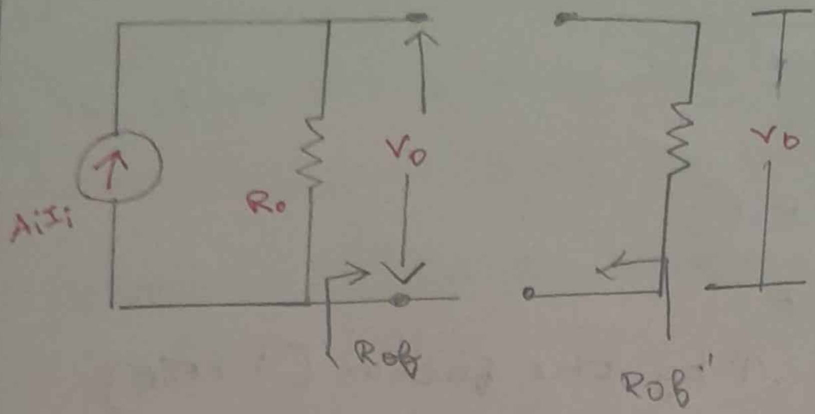
$$= \frac{V_i}{I_i[1+A_i\beta]} \quad \left[\frac{V_i}{I_i} = R_i\right]$$

Input Impedance ↓ by the factor $[1+A_i\beta]$

Output Impedance.

R_L = disconnected

$I_s = 0$



Apply KCL to the output loop

$$I_o = \frac{V_o}{R_o} + A_i V_i \qquad \left[\begin{array}{l} I_i = I_s - I_f \\ I_i = -I_f \end{array} \right]$$

$$I_o = \frac{V_o}{R_o} - A_i V_F \qquad [I_f = \beta I_o]$$

$$= \frac{V_o}{R_o} = I_o[1 + A_i\beta]$$

$$= \frac{V_o}{I_o} = R_o[1 + A_i\beta]$$

$$R_{of} = R_o[1 + A_i\beta] \cdot \qquad \left[\frac{V_o}{I_o} = R_o\right]$$

Output Impedance ↑ by the factor $[1 + A_i\beta]$

Output Impedance with R_L

$$R_{of}' = R_{of} \| R_L$$

$$= \frac{R_{of} \cdot R_L}{R_{of} + R_L}$$

$$= \frac{R_o[1 + A_i\beta]R_L}{R_o[1 + A_i\beta] + R_L}$$

$$R_{of}' = \frac{R_o R_L [1 + A_i\beta]}{R_o + R_L + R_o A_i\beta} \qquad (\therefore R_o + R_L)$$

$$R_{of}' = \frac{\overbrace{\left(\frac{R_o R_L}{R_o+R_L}\right)}^{\to R_o'}(1+A_i\beta)}{1+\left(\frac{R_o A_i\beta}{R_o+R_L}\right) \to A_I\beta}$$

$$R_{of}' = \frac{R_o'\left[1+A_i\beta\right]}{1+A_i\beta}$$

O/P Impedance $\uparrow$ by the factor $[1+A_i\beta]$