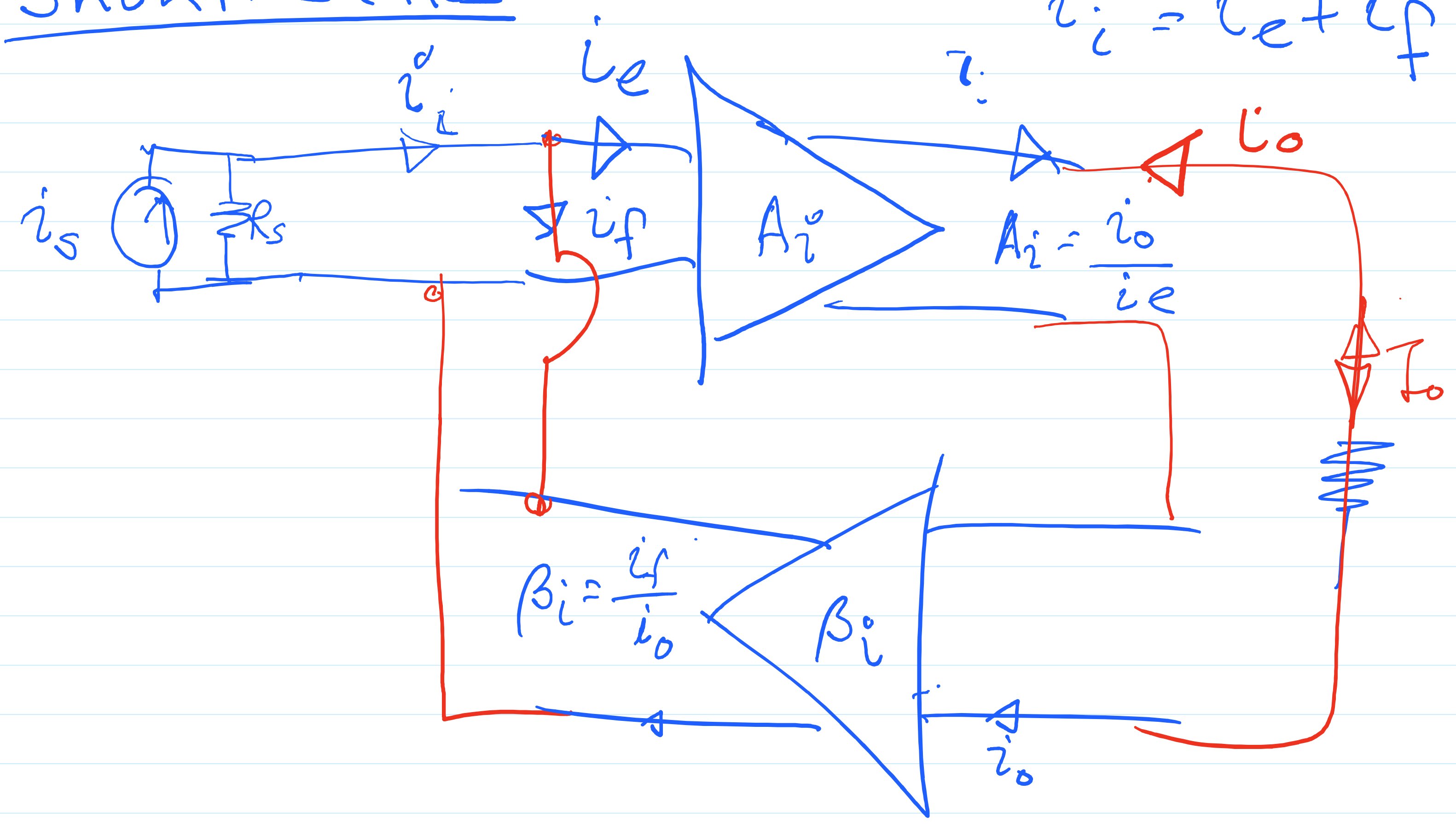
Write down types of feedback amplifier topology and their types of amplification (type of amplifier)

	Topology		Amplifier type
1	Series (v)	Shunt (v)	Voltage Amplifier (A_v)
2	Shunt (i)	Series (i)	Current Amplifier (A_i)
3	Series (v)	Series (i)	Transconductance Amplifier (A_g)
4	Shunt (i)	Shunt (v)	Transresistance Amplifier (A_z)

Shunt-Series

$i_i = i_e + i_f$

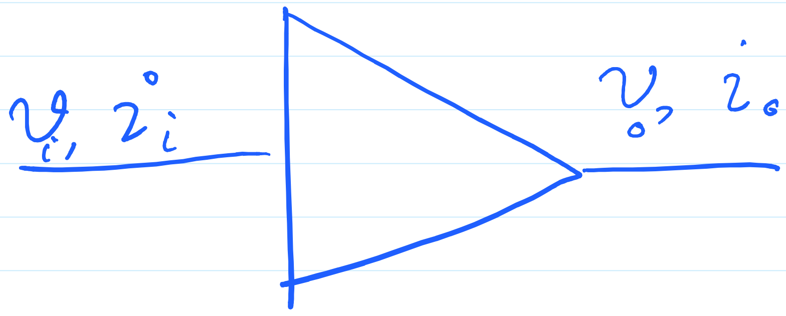


1) Block diagram
(ii) Small signal equivalent ckt.
(iii) Ideal small signal equ. ckt

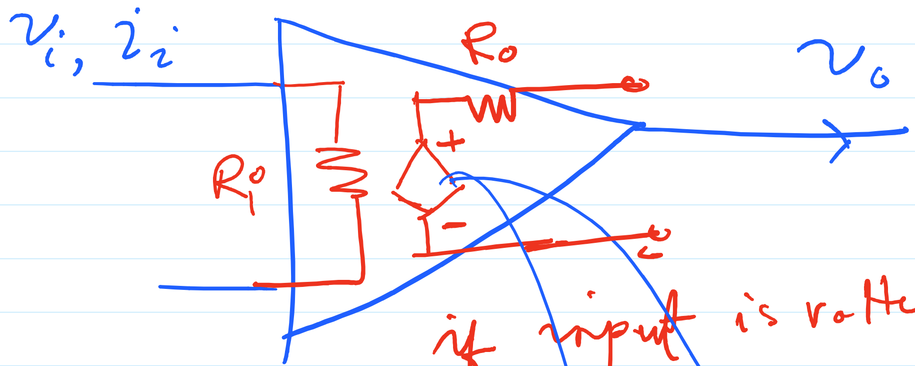
(iv) a) Closed loop gain A_{if}

b) input resistance R_{if}

(c) output resistance R_{of}

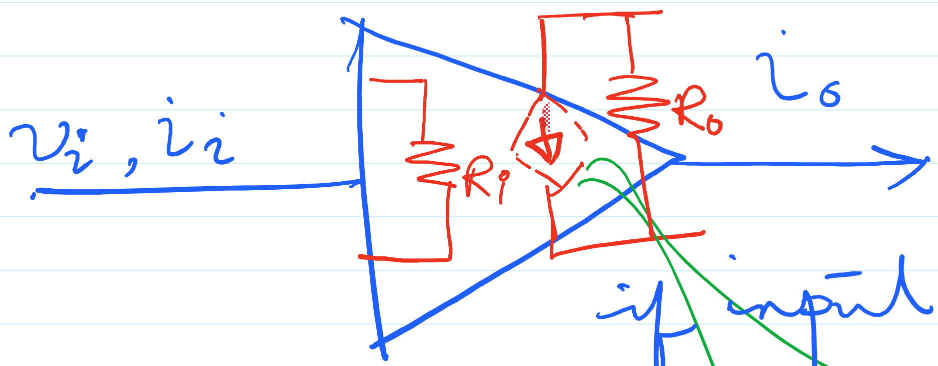


output is voltage.



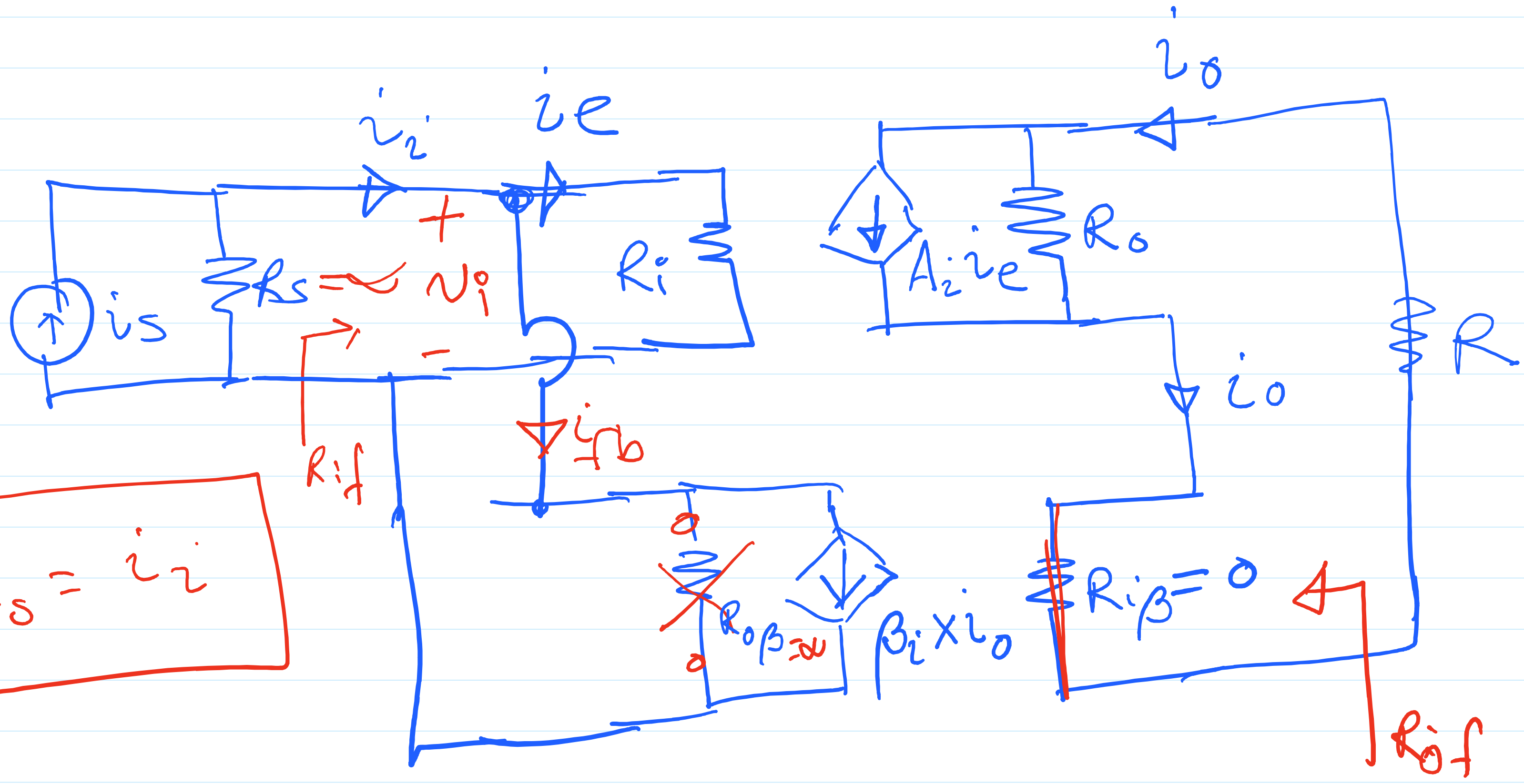
if input is voltage $\Rightarrow A_z \times v_i$

if input is current $\Rightarrow A_z \times i_i$



if input is voltage $\rightarrow A_g \times v_i$ $\left(A_g = \frac{i_o}{v_i}\right)$

if input is current $\rightarrow A_i \times i_i$ $\left[A_i = \frac{i_o}{i_i}\right]$



$$i_s = i_i$$

$$A_i = \frac{i_o}{i_e}$$

$$\beta_i = \frac{i_{fb}}{i_o}$$

$A_{if} \rightarrow$ output (i_o)

$R_{if} \rightarrow$ input (i_e)

$$i_i = i_e + i_{fb}$$

In terms of output (i_o)

$$i_i = \frac{i_o}{A_i} + \beta_i i_o$$

$$i_i = \frac{i_o}{A_i}\left[1 + \beta_i A_i\right]$$

$$A_{if} = \frac{i_o}{i_i} = \frac{A_i}{1 + \beta_i A_i}$$

input parameters (i_e)

$$i_i = i_e + i_{fb}$$

$$= i_e + \beta_i i_o$$

$$= i_e + \beta_i A_i i_e$$

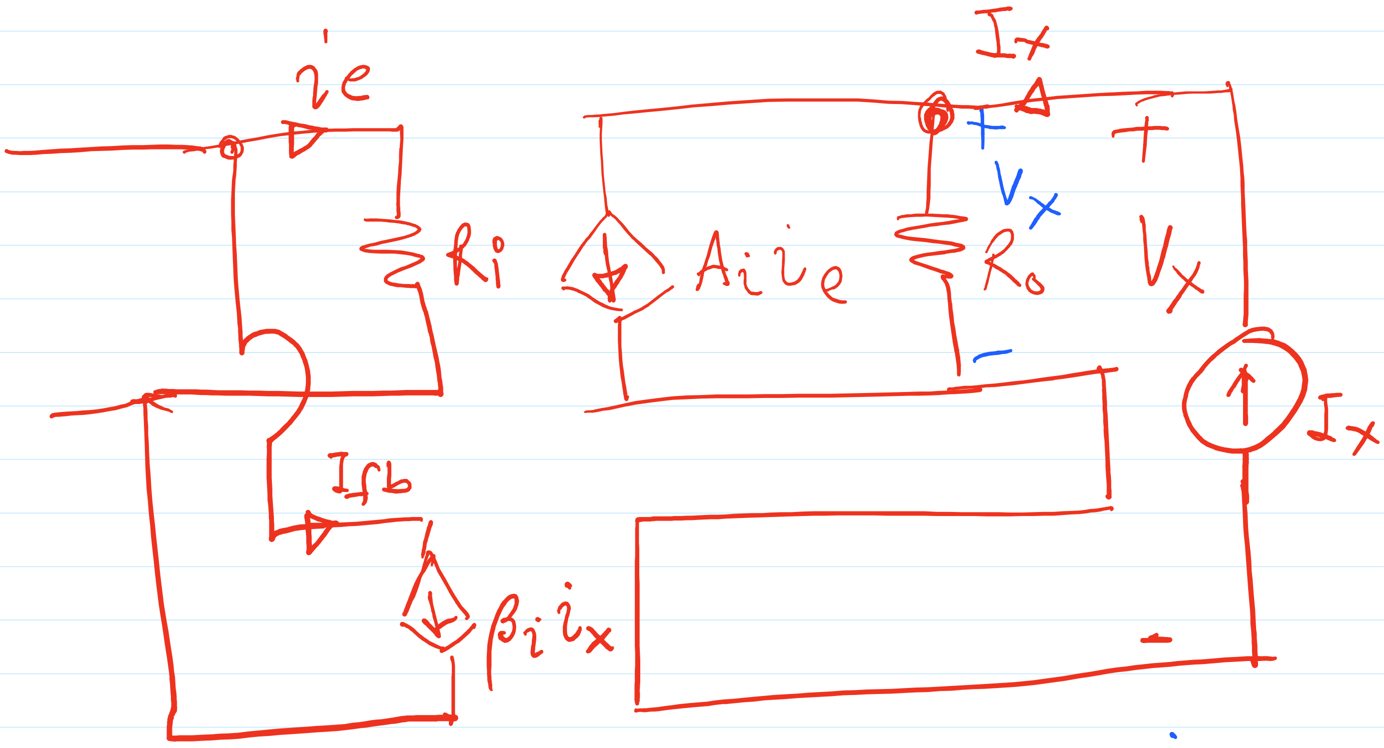
$$= i_e\left[1 + \beta_i A_i\right]$$

$$R_{if} = \frac{v_i}{i_i} = \frac{v_i}{i_e(1 + \beta_i A_i)}$$

($\frac{v_i}{i_e} = R_i$)

i_i ... $i_e(1+\beta_i ...)$

$$= \frac{R_i}{(1+\beta_i A_i)}$$



$$R_{of} = \frac{V_x}{I_x}$$

$$I_x = \frac{V_x}{R_o} + A_i i_e$$

$$0 = i_i = i_e + i_{fb}$$

$$i_e = -i_{fb}$$

$$I_x = \frac{V_x}{R_o} - A_i i_{fb}$$

$$= \frac{V_x}{R_o} - A_i \beta_i i_x$$

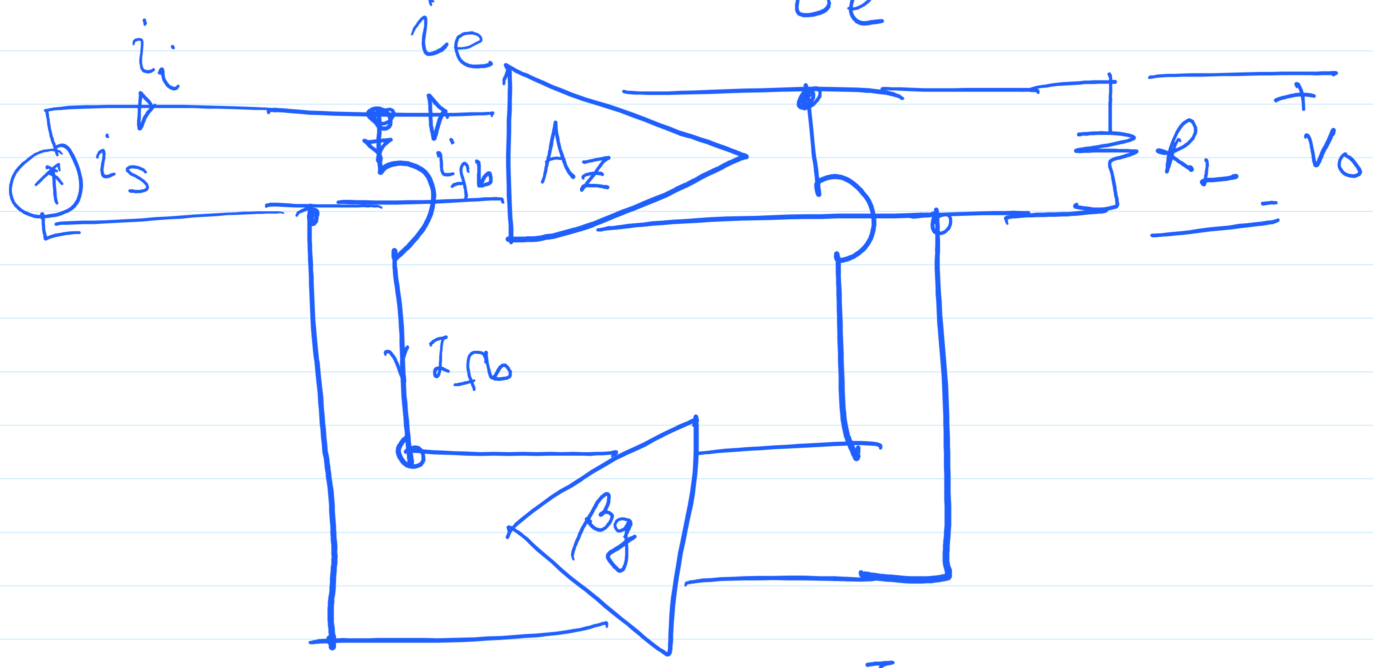
$$I_x [1+\beta_i A_i] = \frac{V_x}{R_o}$$

$$\therefore R_{of} = \frac{V_x}{I_x} = R_o [1+\beta_i A_i]$$

Shunt-shunt

i $\quad$ z_g

$$A_z = \frac{v_o}{i_e}$$



$$\beta_g = \frac{I_{fb}}{v_o}$$

$$A_{zf} = \frac{v_o}{i_s}$$

$R_{if} = ?$

$R_{of} = ?$

$$i_i = i_e + i_{fb}$$

Output v_o — A_{zf}

Input i_e — R_{if}

$$A_z = \frac{v_o}{i_e}$$

$$\beta_g = \frac{i_{fb}}{v_o}$$

$$i_i = \frac{v_o}{A_z} + \beta_g v_o$$

$$= \frac{v_o}{A_z}\left[1 + \beta_g A_z\right]$$

$$\therefore A_{zf} = \frac{v_o}{i_i} = \frac{A_z}{1 + \beta_g A_z}$$

$$i_i = i_e + i_{fb}$$

$$= i_e + \beta_g v_o$$

$$= i_e + \beta_g A_z i_e$$

$$= i_e\left[1 + \beta_g A_z\right]$$

$$\therefore R_{if} = \frac{v_i}{i_e} = \frac{v_i}{i_e(1+\beta_g A_z)}$$

$$= \frac{R_i}{(1+\beta_g A_z)}$$