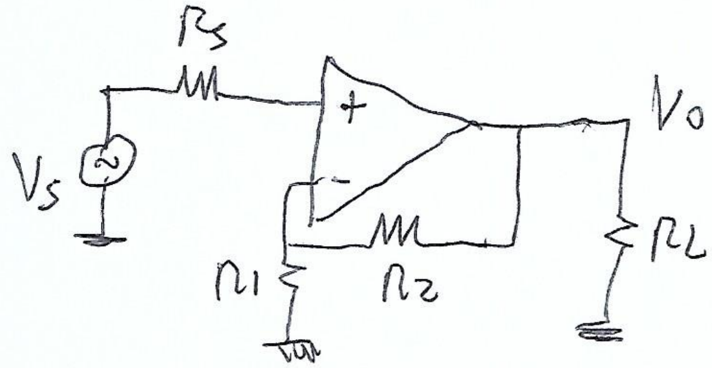
Amplificador operacional no inversor análisis por realimentación



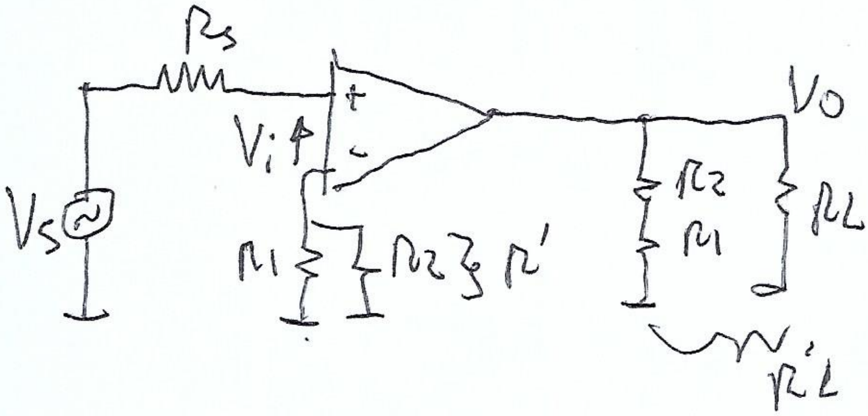
ideal

$$A_{pt} = \frac{V_o}{V_s}$$

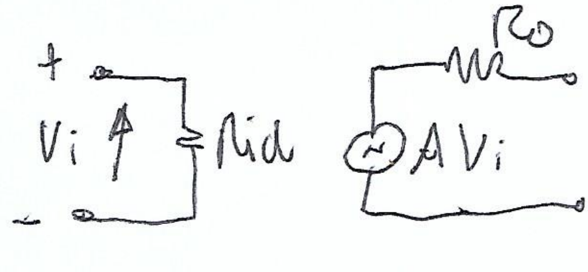
$$A_{pt} = 1 + \frac{R_2}{R_1} = \frac{R_1 + R_2}{R_1}$$

Aplicando método de realimentación

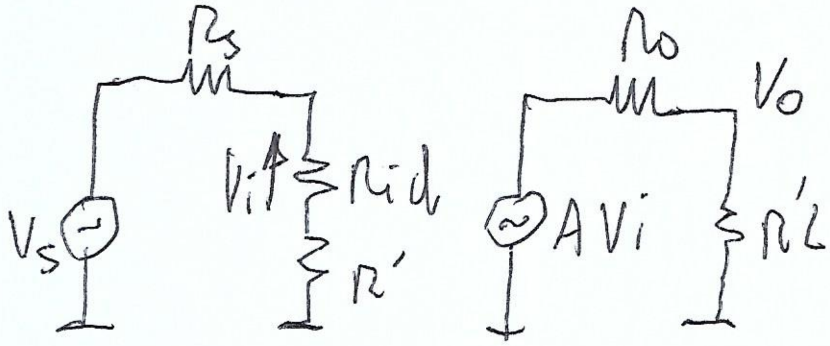
Topología tensión serie – tensión



Modelo equivalente del A.O. modo diferencial



Reemplazando modelo equivalente del A.O.



$$A_{vs} = \frac{V_o}{V_s} = \frac{V_o}{V_i}\frac{V_i}{V_s}$$

$$V_o = A V_i \frac{R'_L}{R'_L + R_o}$$

$$\frac{V_o}{V_i} = A\frac{R'_L}{R'_L + R_o}$$

$$V_i = V_s \frac{R_{id}}{R_s + R_{id} + R'}$$

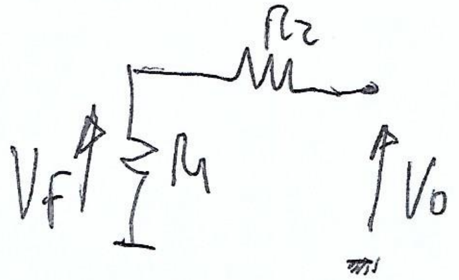
$$\frac{V_i}{V_s} = \frac{R_{id}}{R_s + R_{id} + R'}$$

$$A_{vs} = A\frac{R'_L}{R'_L + R_o}\frac{R_{id}}{R_s + R_{id} + R'}$$

$\wedge$ $R'_L \gg R_o$ y $R_{id} \gg R_s + R'$

$$\boxed{A_{vs} = A}$$

β



$$\beta = \frac{R_1}{R_1+R_2}$$

La ganancia ideal era

$$A_{ft} = \frac{R_1+R_2}{R_1}$$

$$\therefore A_{ft} = \frac{1}{\beta}$$

$$A_{vsf} = \frac{A_{vs}}{1+\beta A_{vs}} = \frac{A}{1+\beta A}$$

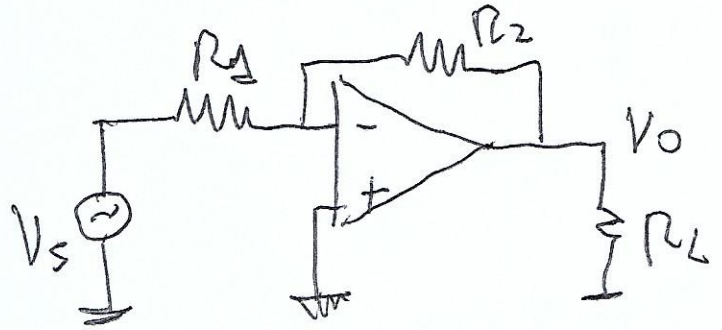
dividiendo por A $\quad A_{vsf} = \dfrac{1}{\beta + \frac{1}{A}}$

multiplicando por $1/\beta$

$$A_{vsf} = \frac{1/\beta}{1+\frac{1}{\beta A}}$$

$$\boxed{A_{vsf} = \frac{A_{ft}}{1+\frac{1}{\beta A}}}$$

Amplificador operacional inversor
análisis por realimentación



ideal

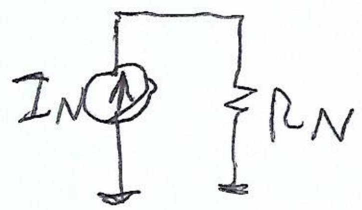
$$A_{ft} = \frac{V_o}{V_s}$$

$$A_{ft} = \frac{-R_2}{R_1}$$

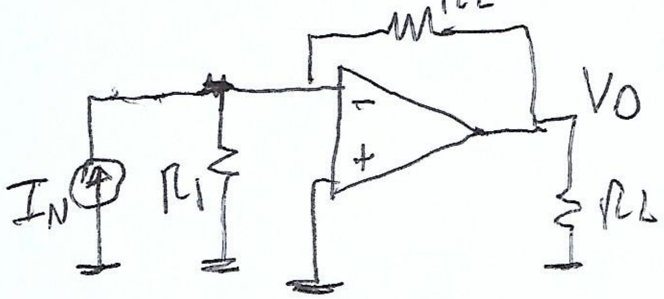
Aplicando método de realimentación

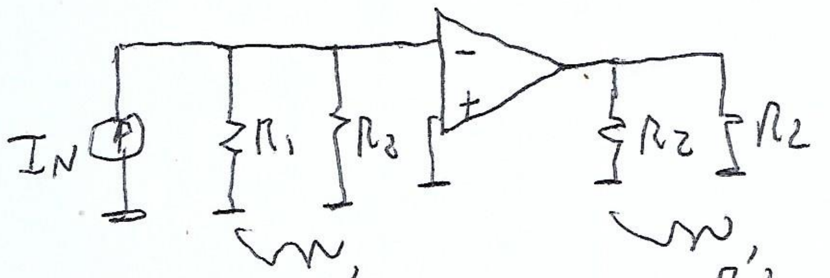
topología tensión - corriente transresistencia

debo aplicar Norton a la entrada

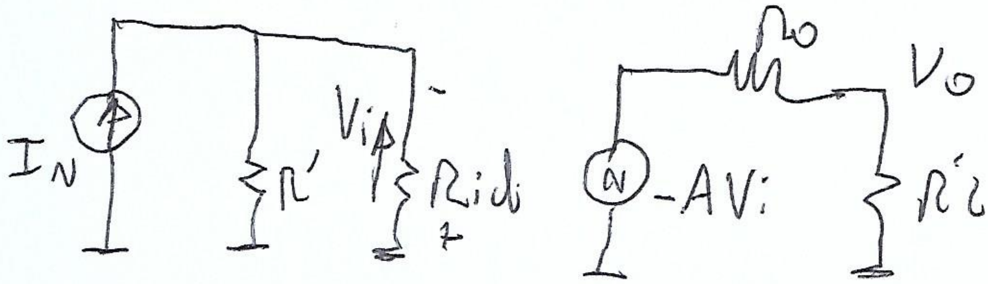


$I_N = \frac{V_s}{R_1}$ $R_N = R_1$





Reemplazando modelo equivalente del A.O.



$$R_{MS} = \frac{V_o}{I_N} = \frac{V_o}{V_i}\,\frac{V_i}{I_N}$$

$$V_o = -A V_i \frac{R'_L}{R'_L + R_o}$$

$$\frac{V_o}{V_i} = -A \frac{R'_L}{R'_L + R_o}$$

$$V_i = I_N (R' \parallel R_{id})$$

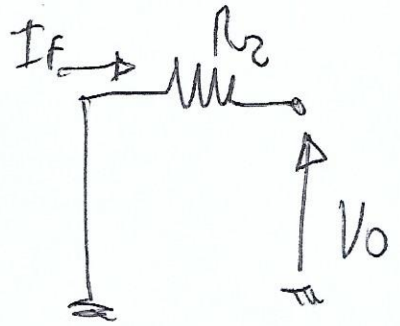
$$\frac{V_i}{I_N} = \frac{R' R_{id}}{R_{id} + R'}$$

$$R_{MS} = -A \frac{R'_L}{R'_L + R_o}\,\frac{R_{id} R'}{R_{id} + R'}$$

Si $R'_L \gg R_o$ y $R_{id} \gg R'$

$$\boxed{R_{MS} = -A R'}$$

β



$\beta = -\frac{1}{R_2}$ ∴ la ganancia de transresistencia ideal es $-R_2$

$$R_{msf} = \frac{R_{ms}}{1+\beta R_{ms}} = \frac{-AR'}{1+\beta(-AR')}$$

$$R_{msf} = \frac{-AR'}{1+\frac{1}{R_2}AR'} = \frac{-1}{\frac{1}{AR'}+\frac{1}{R_2}}$$

$$R_{msf} = \frac{-R_2}{1+\frac{R_2}{AR'}}$$

$$R_{msf} = \frac{-R_2}{1+\frac{\cancel{R_2}}{A\frac{R_1\cancel{R_2}}{R_1+R_2}}}$$

denominamos $\beta' = \frac{R_1}{R_1+R_2}$

$$R_{msf} = \frac{-R_2}{1+\frac{1}{\beta' A}}$$

es el mismo denominador en ambos casos

Ganancia de tensión realimentada

$$A_{vsF} = \frac{V_o}{V_s} \qquad I_N = \frac{V_s}{R_1} \therefore V_s = I_N R_1$$

$$R_{msF} = \frac{V_o}{I_N}$$

$$A_{vsF} = \frac{V_o}{I_N \cdot R_1} \qquad A_{vsF} = \frac{R_{msF}}{R_1}$$

$$A_{vsF} = -\frac{R_2}{R_1} \frac{1}{1 + \frac{1}{\beta' A}} \qquad A_{pt} = -\frac{R_2}{R_1}$$

$$\boxed{A_{vsF} = \frac{A_{pt}}{1 + \frac{1}{\beta' A}}}$$

	$\overline{INV}$	INV
A_{pt}	$\frac{R_2 + R_1}{R_1} = 1 + \frac{R_2}{R_1}$	$-\frac{R_2}{R_1}$

$\beta = \beta'$ $\therefore$ análisis del denominador no depende del uso por lo tanto tampoco de la señal