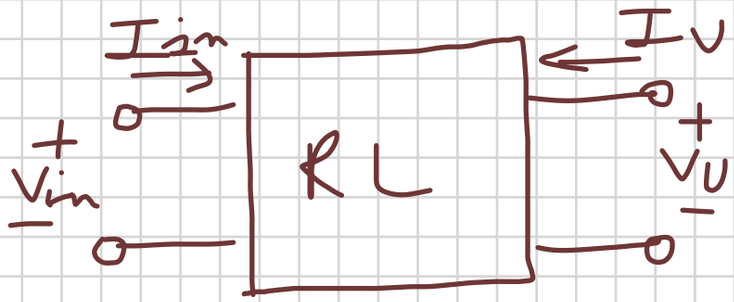
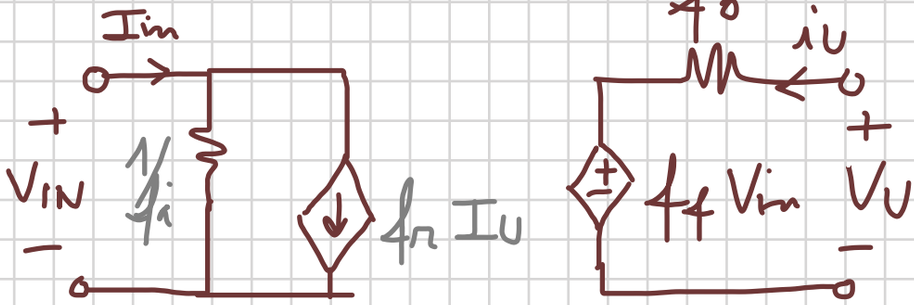
Tensione $V_U = A_V V_{in}$

Corrente $I_U = A_I I_{in}$

Transconduttiva $I_U = G V_{in}$

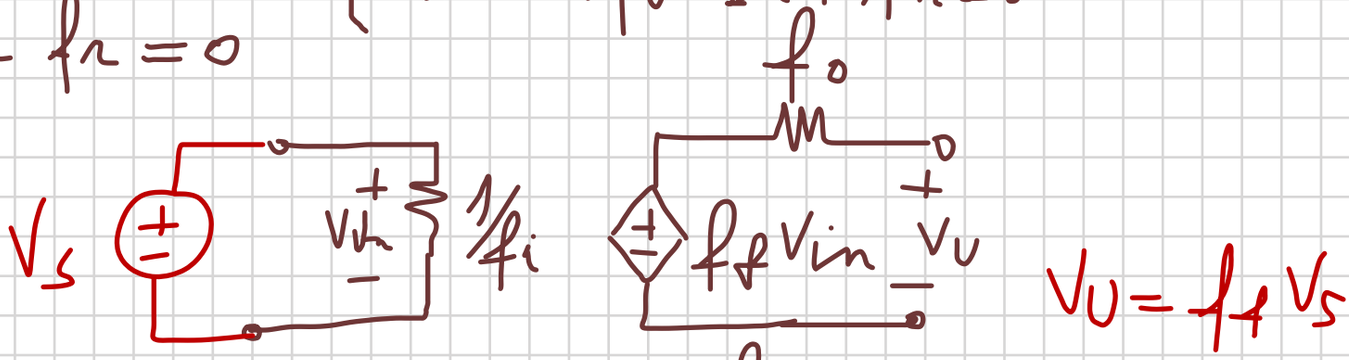
Transresistiva $V_U = R I_{in}$



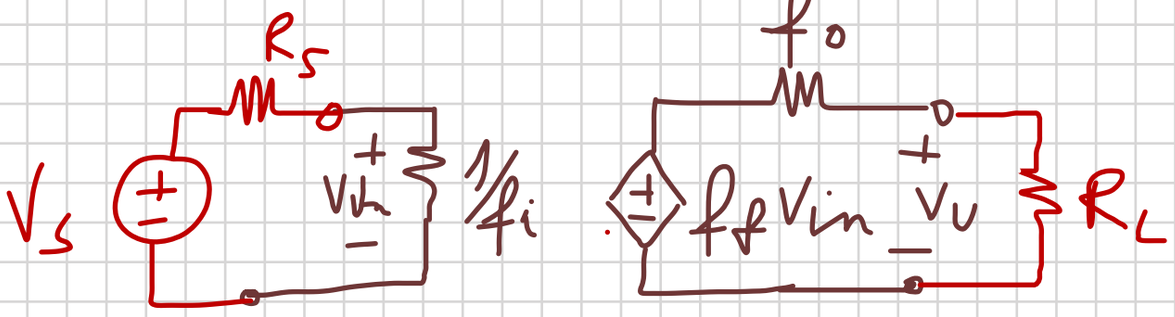


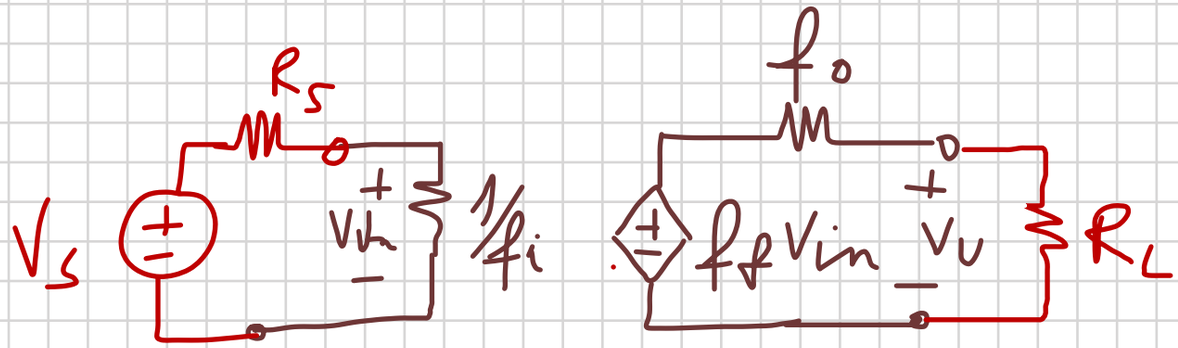
$$\begin{cases} V_U = f_f V_{in} + f_o i_U \\ I_{in} = f_V V_{in} + A_r I_U \end{cases}$$

Se $f_r = 0$



$V_U = f_f V_S$





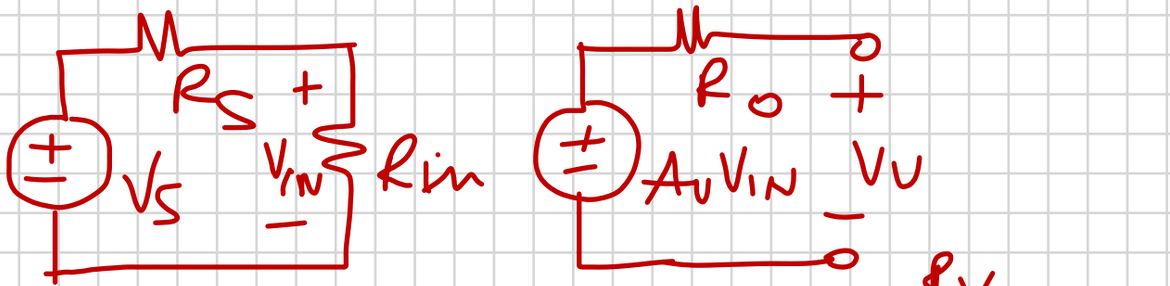
$$V_{in} = \frac{1/f_i}{1/f_i + R_S} V_S \; ; \; V_U = \frac{R_L}{R_L + f_0} f_f V_{in}$$

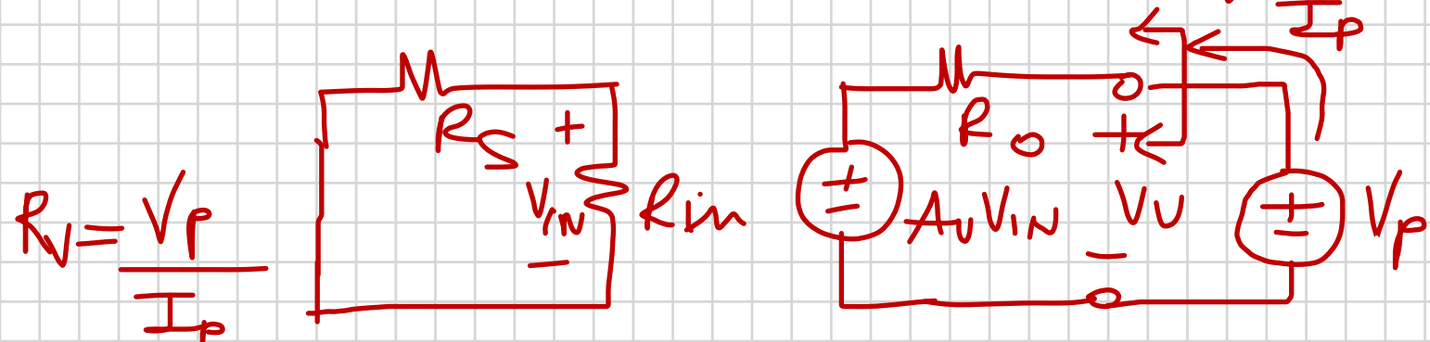
$$V_U = \underbrace{\frac{R_L}{R_L + f_0} f_f \frac{1}{1/f_i + R_S}}_{A_V} V_S$$

$$\frac{1}{f_i} \gg R_S \Rightarrow \frac{1}{1/f_i + R_S} \simeq 1$$

$$f_0 \ll R_L \Rightarrow \frac{R_L}{R_L + f_0} \simeq 1$$

$$\Rightarrow \boxed{V_U = f V_S}$$

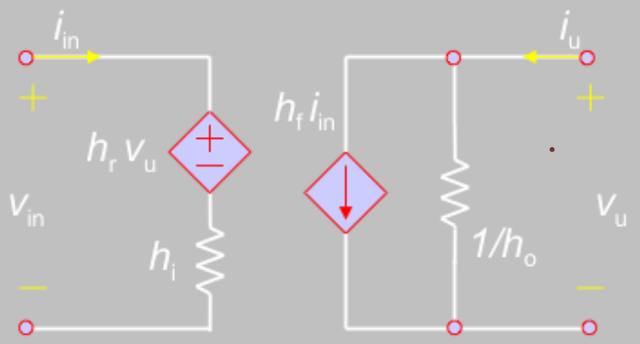


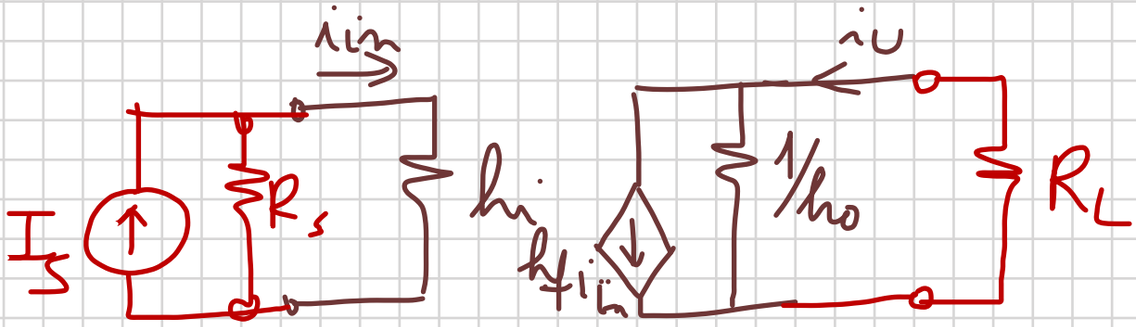


$$V_p = R_o I_p + A_v V_{IN}$$

$$V_{IN} = 0 \Rightarrow V_p = R_o I_p \Rightarrow \frac{V_p}{I_p} = R_J = R_o$$

$$\begin{cases} i_u = h_f i_{in} + h_o v_u \\ v_{in} = h_i i_{in} + h_r v_u \end{cases}$$





$$i_{in} = \frac{R_S}{R_S + h_i} I_S \qquad R_S \gg h_i \Rightarrow$$

$$\Rightarrow i_{in} = I_S$$

$$i_u = h_f i_{in} \frac{1/h_o}{1/h_o + R_L}$$

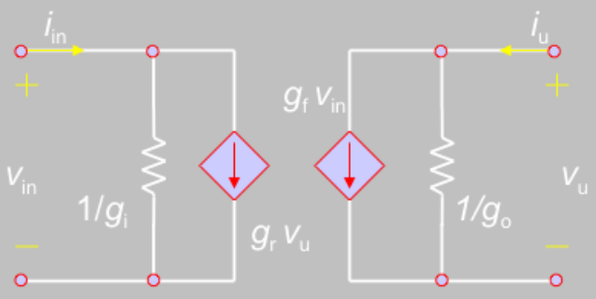
$$1/h_o \gg R_L \Rightarrow i_u \simeq h_f i_{in} \simeq h_f I_S$$

Amplificatore transconduttivo

Equazioni

$$\begin{cases} i_u = g_f v_{in} + g_o v_u \\ i_{in} = g_i v_{in} + g_r v_u \end{cases}$$

Modello

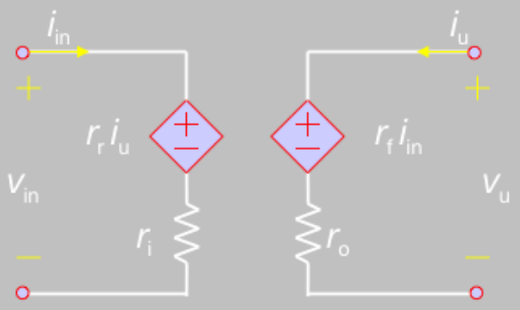


Amplificatore transresistivo

Equazioni

$$\begin{cases} v_u = r_f i_{in} + r_o i_u \\ v_{in} = r_i i_{in} + r_r i_u \end{cases}$$

Modello



$$\begin{cases} V_u = f_f V_{in} + f_o i_u \\ i_{in} = f_i V_{in} + f_r i_u \end{cases}$$

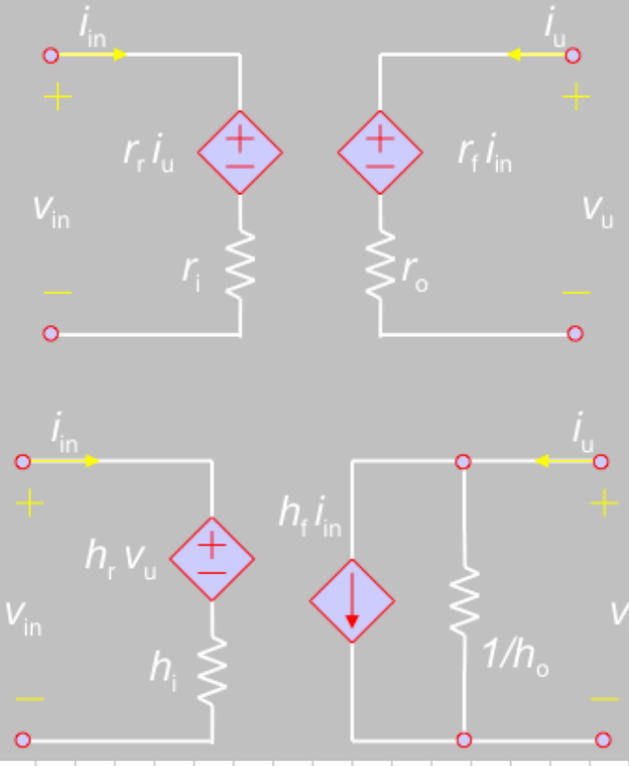
$$f_f = \left.\frac{V_U}{V_S}\right|_{I_U=0} \Rightarrow \text{USCITA APERTA}$$

$$f_o = \left.\frac{V_U}{I_U}\right|_{V_{in}=0} \Rightarrow \text{INGRESSO IN C.C.}$$

$$f_i = \left.\frac{i_{in}}{V_{in}}\right|_{i_U=0}$$

$$f_r = \left.\frac{i_{in}}{i_U}\right|_{V_{in}=0}$$

Da transresistivo ad amplificatore di corrente

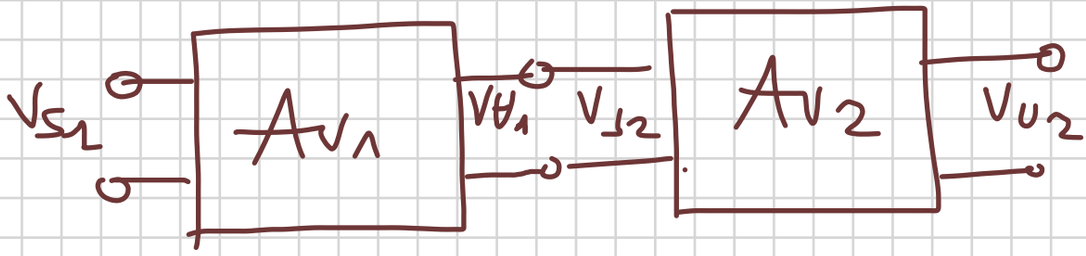


$$h_f = \left.\frac{i_u}{i_{in}}\right|_{v_u=0} = -\frac{r_f}{r_o}$$

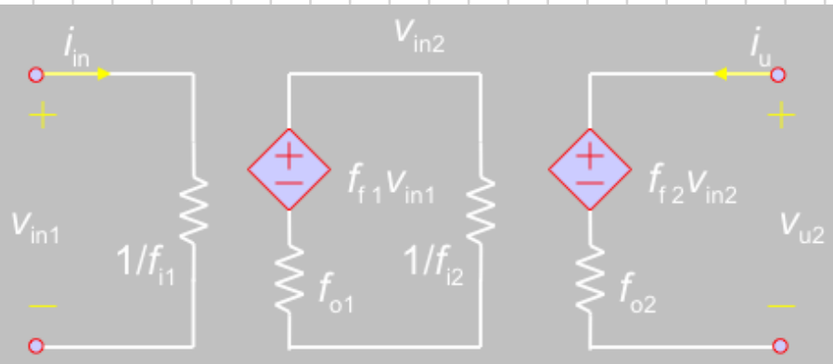
$$h_o = \left.\frac{i_u}{v_u}\right|_{i_{in}=0} = \frac{1}{r_o}$$

$$h_i = \left.\frac{v_{in}}{i_{in}}\right|_{v_u=0} = r_i - r_r\frac{r_f}{r_o}$$

$$h_r = \left.\frac{v_{in}}{v_u}\right|_{i_{in}=0} = \frac{r_r}{r_o}$$



$$V_{U2} = A_{V2} A_{V1} V_S$$



$$v_{u2} = \frac{f_{f2} f_{f1}}{1 + f_{i2} f_{o1}} v_{in1} + f_{o2} i_{u2}$$

$$i_{in1} = f_{i1} v_{in1}$$