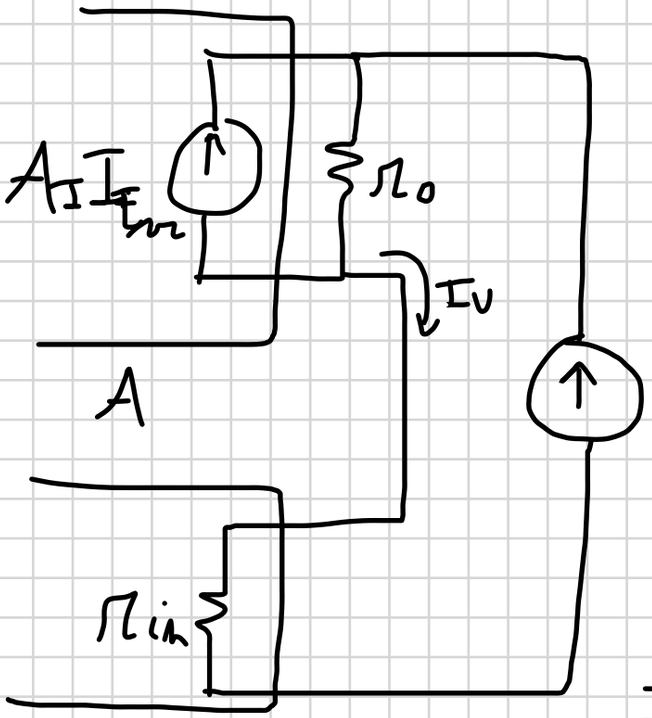


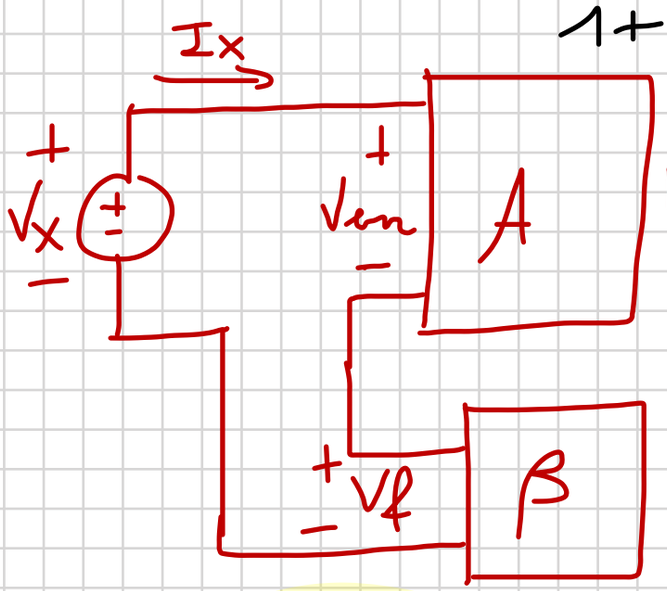
$$V_o = R_o A_I I_{Err} =$$

$$= R_o A_I I_S$$

$$I_{ERR} = I_S - I_f$$

$$I_{Sc} = \frac{A I_S}{1+\beta A}$$

$$R_V = \frac{V_o}{I_{Sc}} = \frac{R_o A_I I_S}{\frac{A_I I_S}{1+\beta A}} = R_o (1+\beta A)$$



$$R_{IN} = \frac{V_X}{I_X} \Rightarrow$$

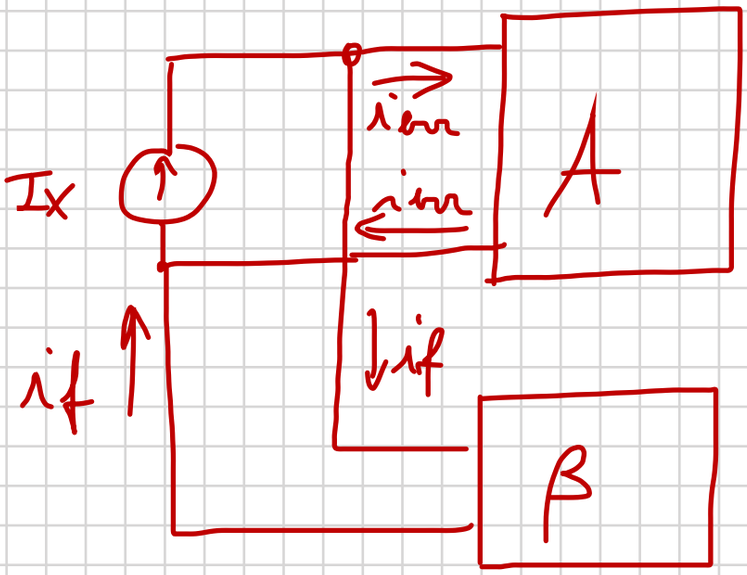
$$I_X = \frac{V_{Err}}{Z_{AIN}}$$

$$V_U = A V_{Err.}$$

$$V_U = \frac{A}{1+\beta A} V_X$$

$$V_{Em} = \frac{V_X}{1+\beta A}$$

$$I_X = \frac{V_X}{Z_{AIN}(1+\beta A)} \Rightarrow R_{IN} = Z_{AIN}(1+\beta A)$$



$$V_X = Z_{AIN}\, i_{in} = \frac{Z_{AIN}\, I_S}{1+\beta A}$$

$$Z_{IN} = \frac{V_X}{I_X} = \frac{Z_{AIN}}{1+\beta A}$$

$$A_f = \frac{A}{1+\beta A} \qquad A = \frac{A_0}{1+\frac{s}{\omega_p}}$$

$$\beta = \beta_0$$

$$A_f = \frac{\frac{A_0}{\left(1+\frac{s}{\omega_p}\right)}}{1+\frac{\beta_0 A_0}{\left(1+\frac{s}{\omega_p}\right)}} = \frac{A_0}{1+\frac{s}{\omega_p}+\beta_0 A_0} =$$

$$= \frac{A_0}{(1+\beta_0 A_0)\left[1+\frac{s}{\omega_p(1+\beta_0 A_0)}\right]} = \frac{A_{f0}}{1+\frac{s}{\omega_p'}}$$

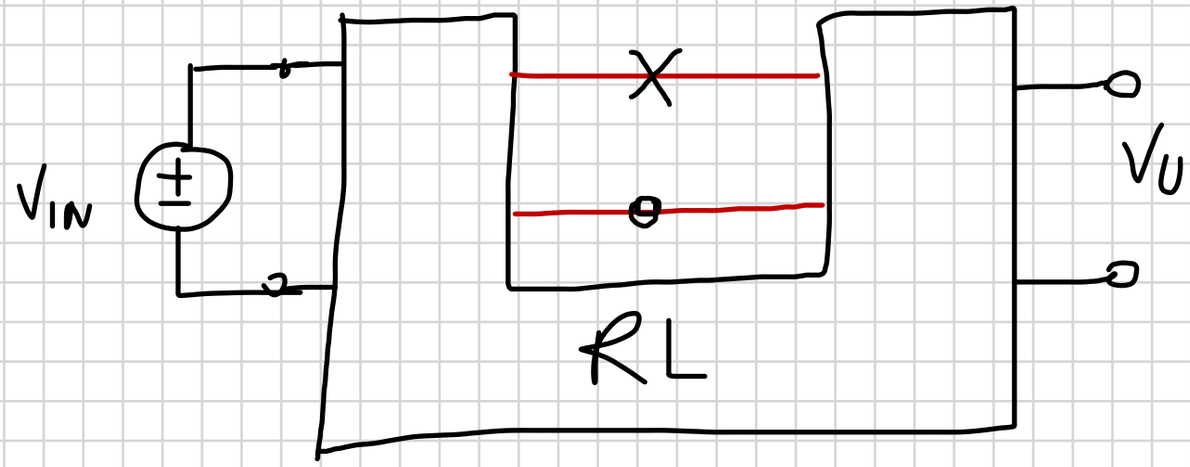
$$A_{f0} = \frac{A_0}{1+\beta_0 A_0} \quad ; \quad \omega_p' = \omega_p(1+\beta_0 A_0)$$

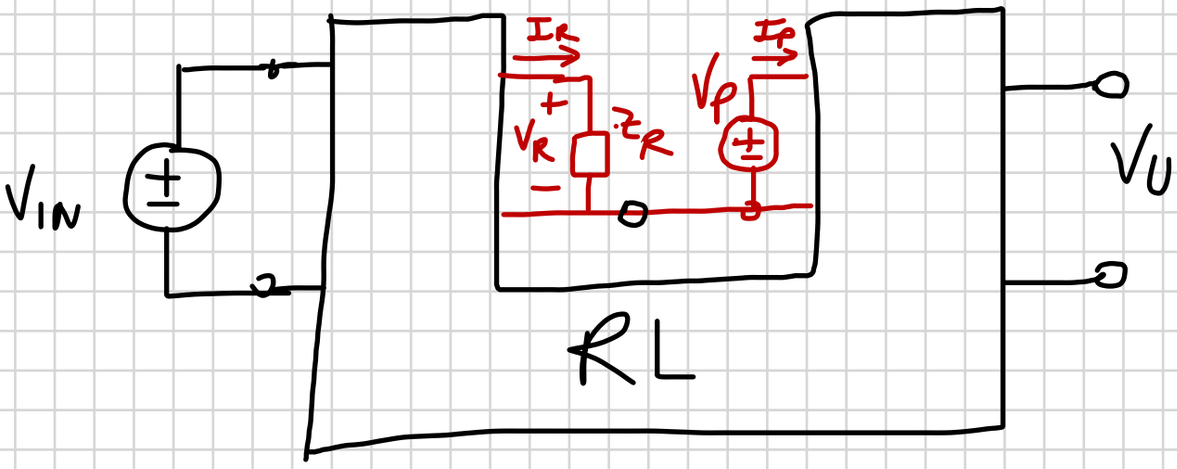
$$PGB = A\,\omega_p$$

$$A_0\,\omega_p$$

$$\frac{A_0}{(1+\beta_0 A_0)}\cdot \omega_p\,(1+\beta_0 A_0)$$

$$(PGB)_{RNR} \geq (PGB)_{RR}$$





$$A = \left.\frac{V_u}{V_p}\right|_{V_s=0} \qquad \beta = \left.\frac{V_r}{V_u}\right|_{V_s=0}$$

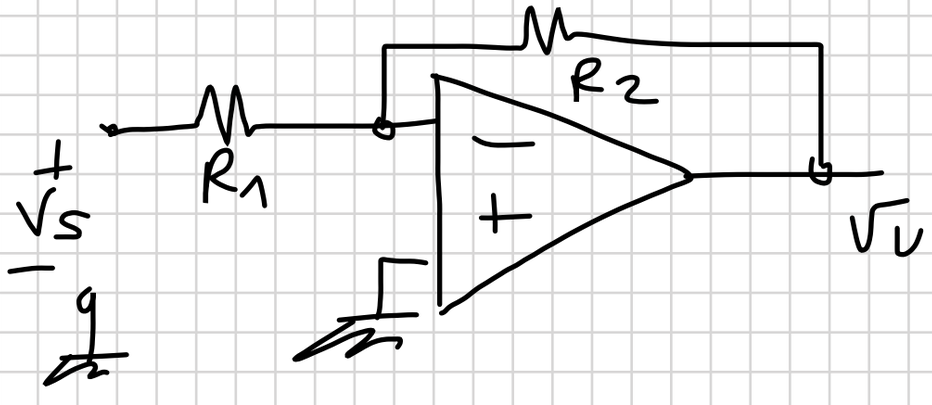
$$Z_p = \left.\frac{V_p}{I_p}\right|_{V_s=0} \qquad \alpha = \left.\frac{V_r}{V_s}\right|_{V_p=0}$$

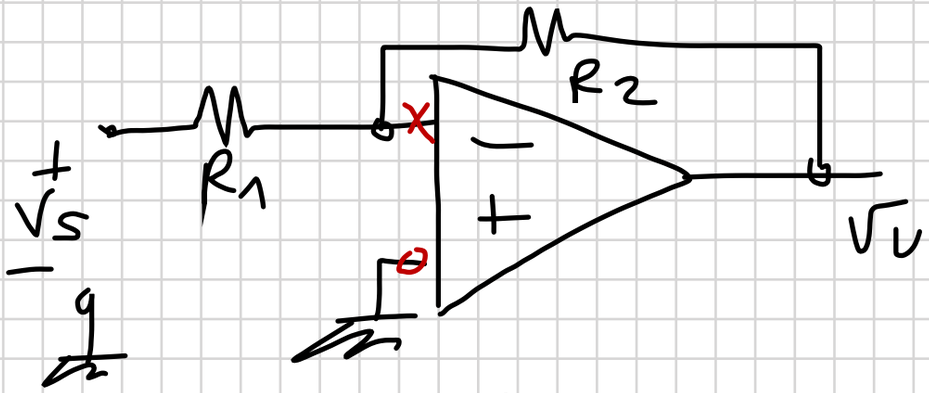
$$\gamma = \left.\frac{V_u}{V_s}\right|_{V_p=0} \qquad \rho = \left.\frac{I_p}{V_r}\right|_{V_p=0}$$

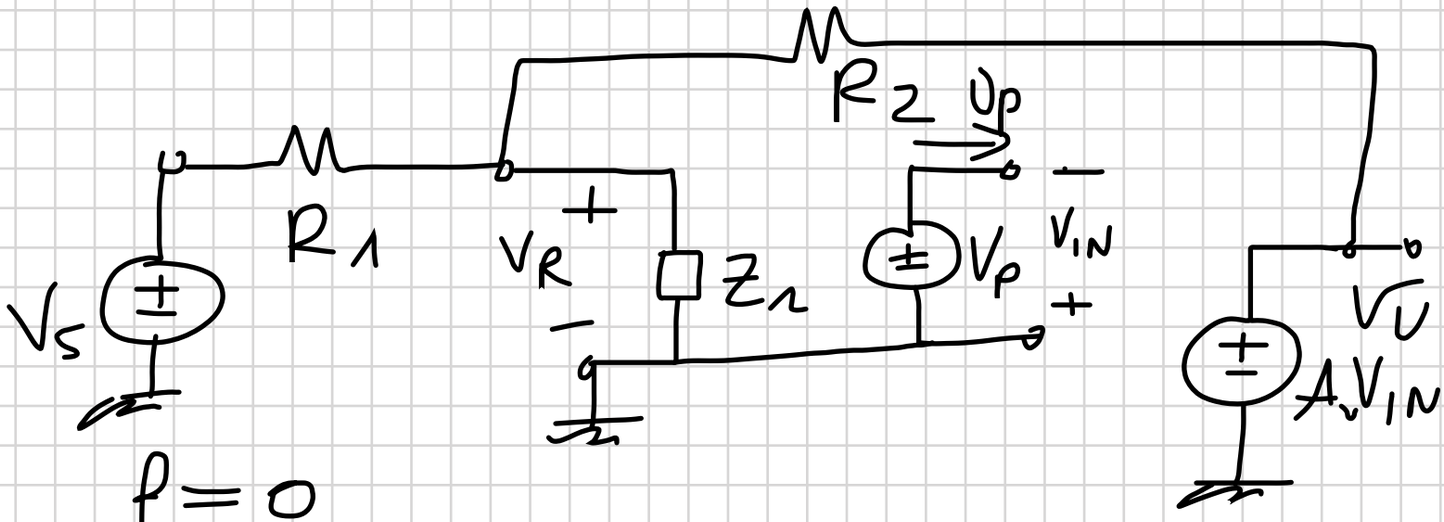
$$\frac{1}{Z_r} = \frac{1}{Z_p} + \rho(1-\beta A)$$

$$V_p = V_s \frac{\alpha}{1-\beta A}$$

$$A_f = \frac{\alpha A}{1-\beta A} + \gamma$$

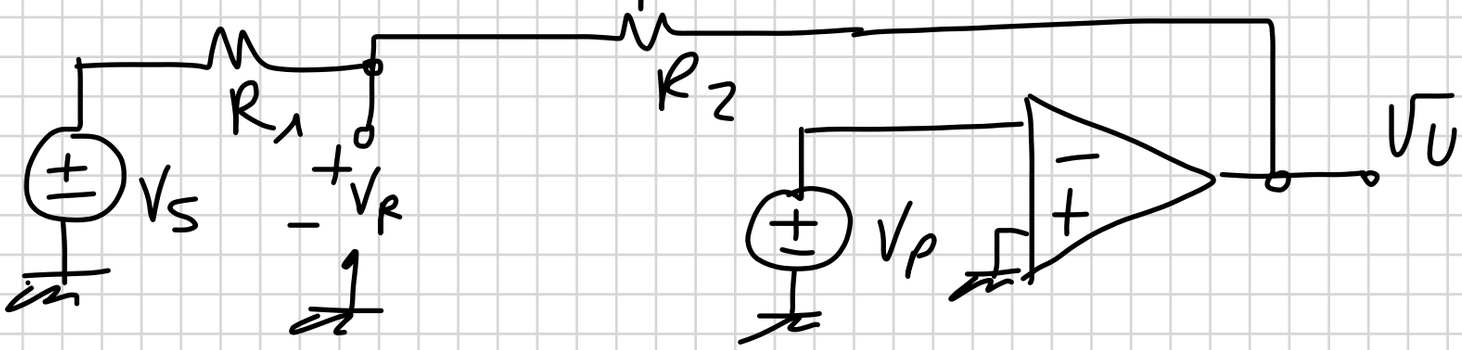




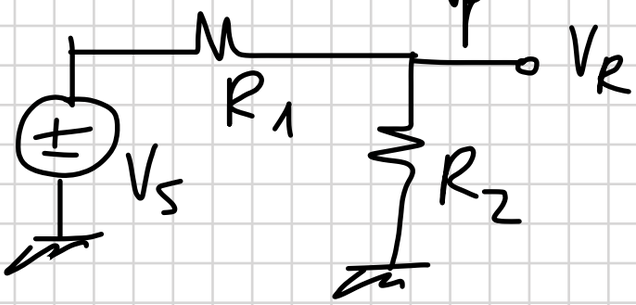


$f = 0$

$Z_1 = Z_p \to +\infty$

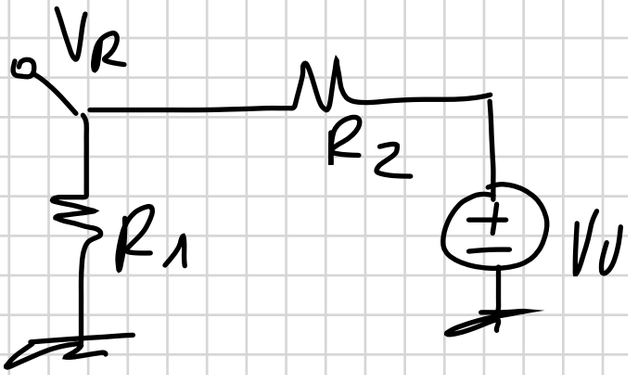


$$\alpha = \left.\frac{V_R}{V_S}\right|_{V_p = 0}$$



$$\alpha = \frac{R_2}{R_1 + R_2} = \alpha_0$$

$$\beta = \left.\frac{V_R}{V_U}\right|_{V_S=0}$$



$$\beta = \frac{R_1}{R_1+R_2} = \beta_0$$

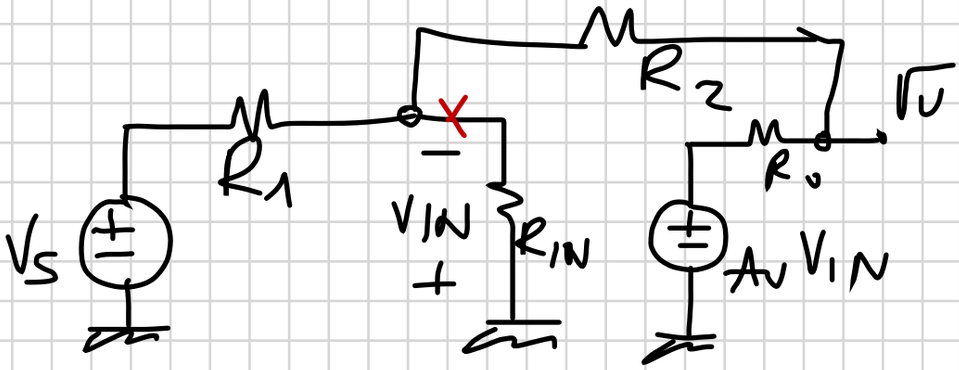
$$A = \left.\frac{V_U}{V_P}\right|_{V_S=0} = -A_V$$

$$\gamma = \left.\frac{V_U}{V_S}\right|_{V_P=0} = 0$$

$$A_f = \frac{\alpha A}{1-\beta A} = \frac{\frac{R_2}{R_1+R_2}\cdot(-A_V)}{1+A_V\frac{R_1}{R_2+R_1}} =$$

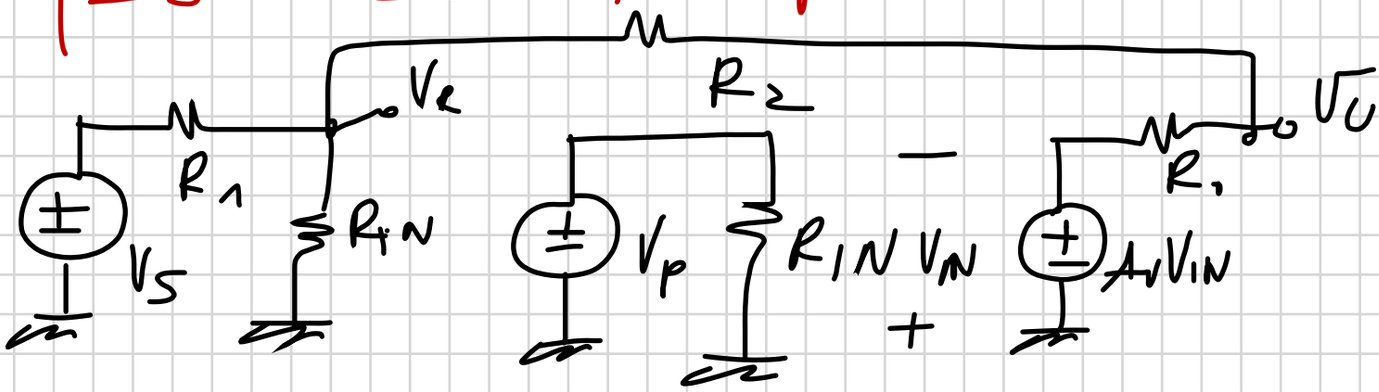
$$= \frac{R_2(-A_V)}{(R_2+R_1)+A_V R_1}$$

Se $A_V \to +\infty$ $\quad A_f = -\frac{R_2}{R_1}$

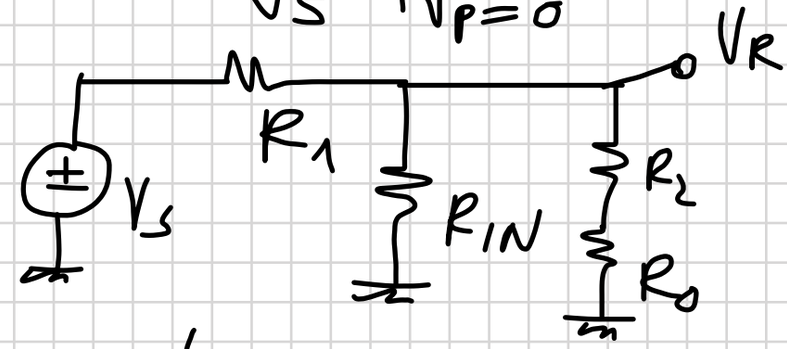


$$A_V = \frac{A_{VOLd}}{1+\frac{s}{\omega_p}}$$

$f = 0 \qquad Z_r = R_{IN} = Z_p$

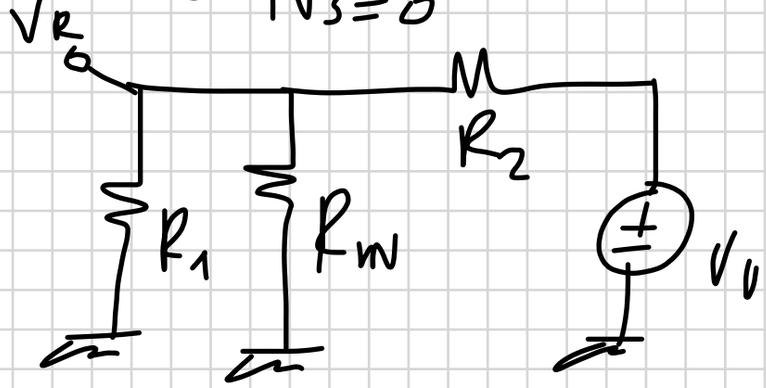


$$\alpha = \left.\frac{V_R}{V_S}\right|_{V_P=0}$$



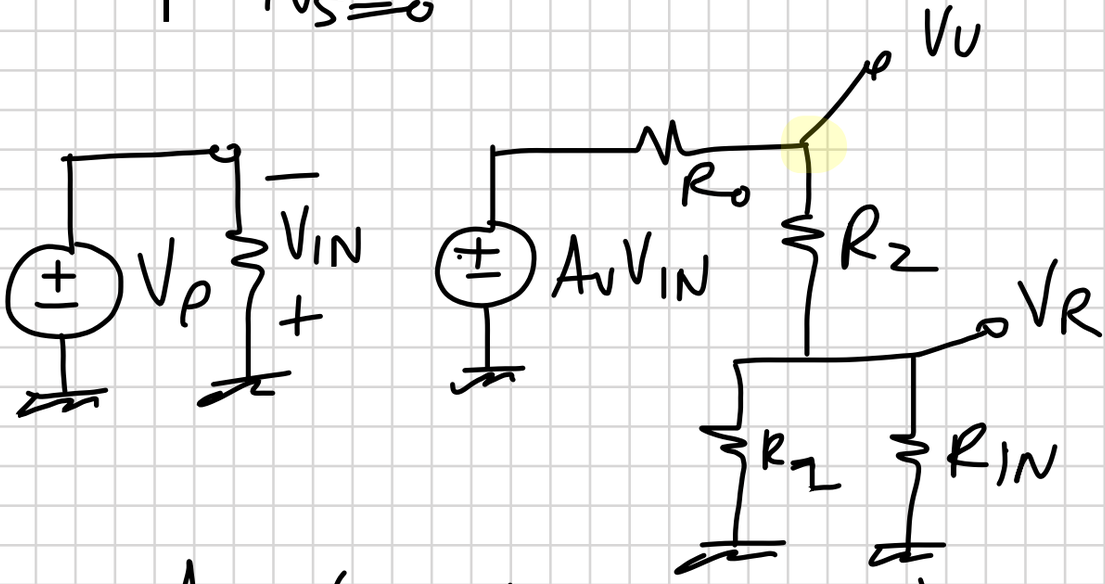
$$\alpha = \frac{R_{IN} \,//\, (R_2+R_0)}{R_1 + R_{IN} \,//\, (R_2+R_0)}$$

$$\beta = \left.\frac{V_R}{V_U}\right|_{V_S=0} \Longrightarrow$$



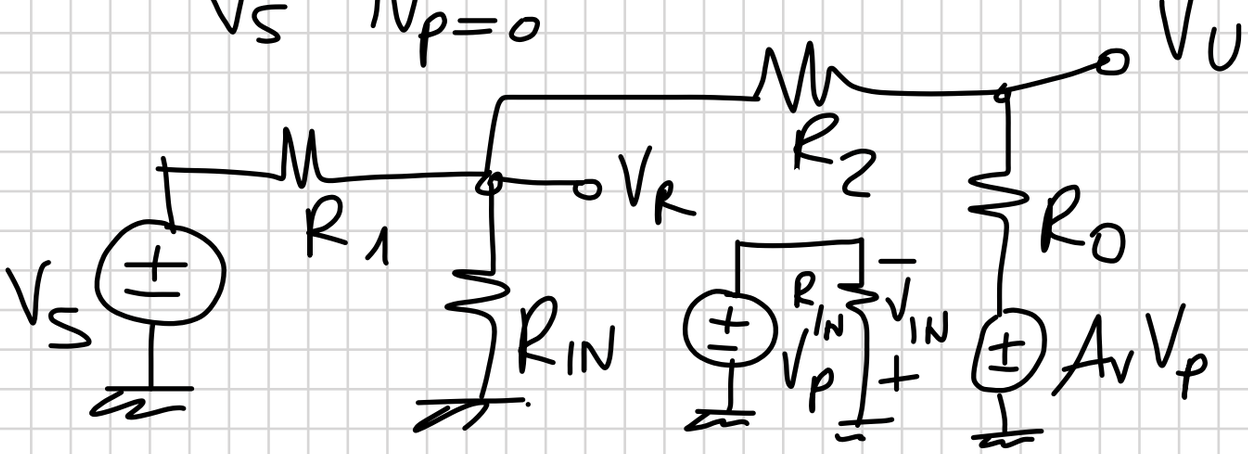
$$\beta = \frac{R_1 \,//\, R_{IN}}{R_1 \,//\, R_{IN} + R_2}$$

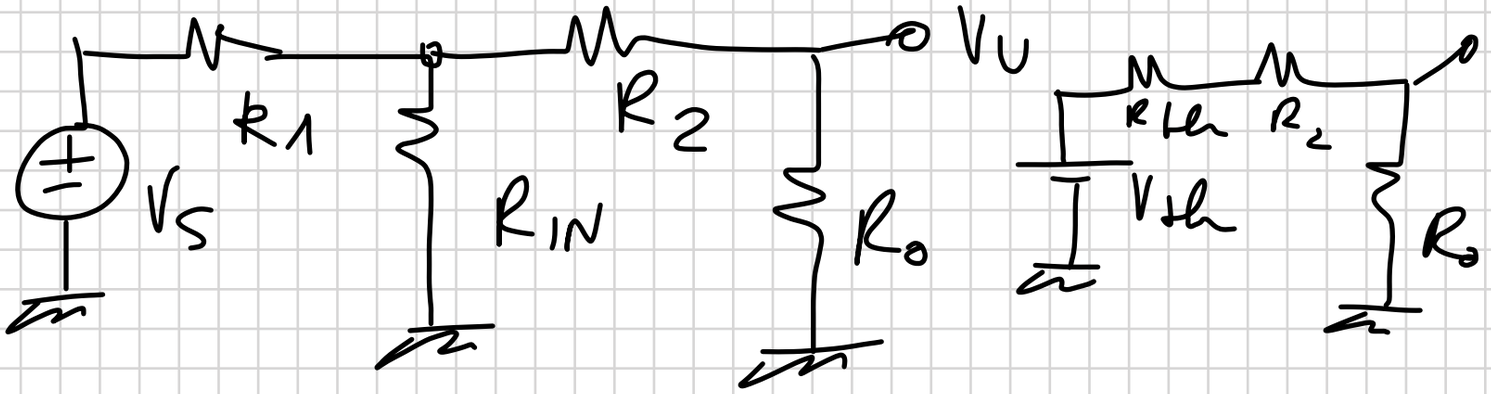
$$A = \left.\frac{V_U}{V_P}\right|_{V_S=0}$$



$$A = -\frac{A_{VOL}}{1+\frac{s}{\omega_p}} \cdot \frac{(R_1 // R_{IN} + R_2)}{R_1 // R_{IN} + R_2 + R_0}$$

$$\gamma = \left.\frac{V_U}{V_S}\right|_{V_P=0} = .$$





$$\gamma = \gamma_0 = \frac{R_0}{R_2 + R_0 + R_1 // R_{IN}} \cdot \frac{R_{IN}}{R_{IN} + R_1}$$