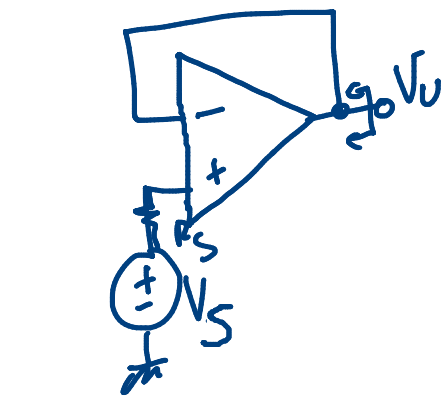
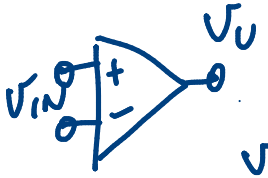
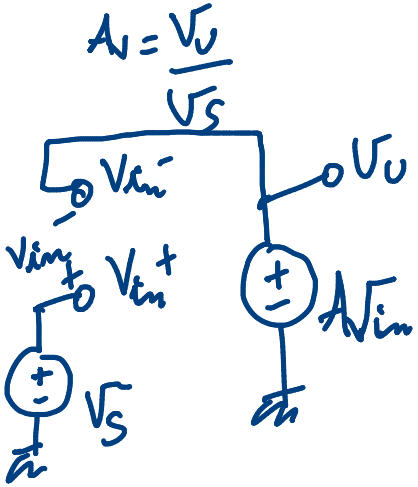




$A_V = \frac{V_U}{V_S}$

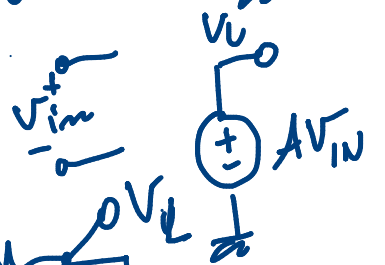


$V_U = AV_{IN}$

$V_{IN} = V_S - V_U$

$V_U = AV_S - AV_U$

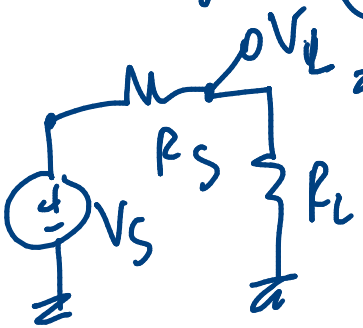
$(1+A)V_U = AV_S$



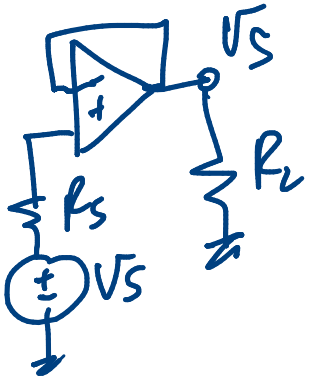
$V_L = AV_{IN}$

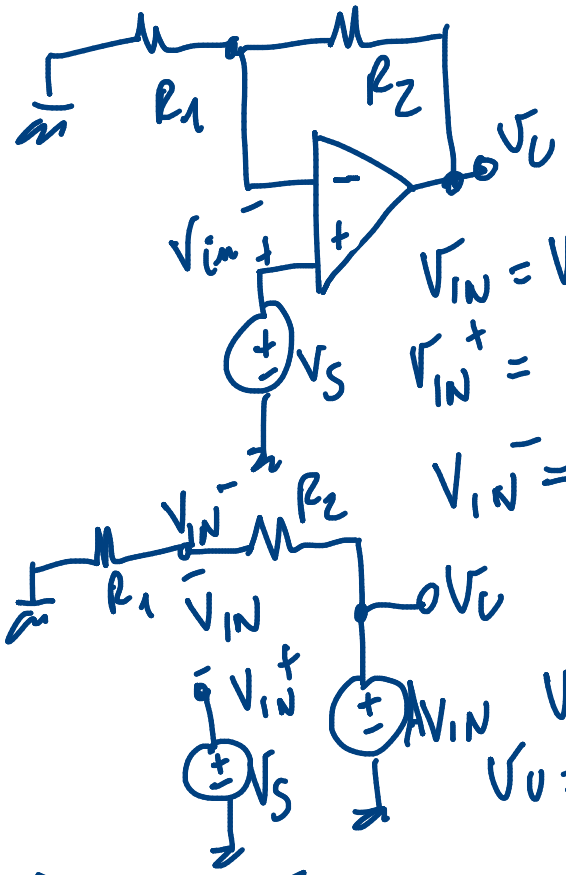
$A_V = \frac{V_U}{V_S} = \frac{A}{1+A}$

$A \to +\infty \Rightarrow A_V \to 1$



$V_L = \frac{R_L}{R_L + R_S} V_S$





$$V_{IN} = V_{IN}^{+} - V_{IN}^{-}$$

$$V_{IN}^{+} = V_S$$

$$V_{IN}^{-} = \frac{R_1}{R_1+R_2} V_U$$

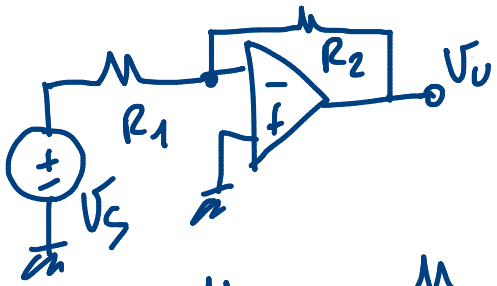
$$V_U = A V_{IN}$$

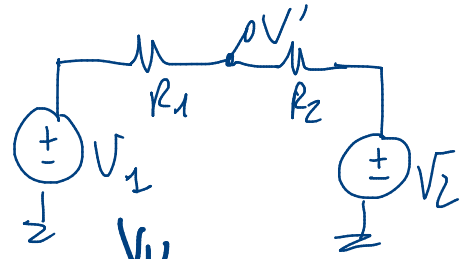
$$V_U = A V_S - \frac{A R_1}{R_1+R_2} V_U$$

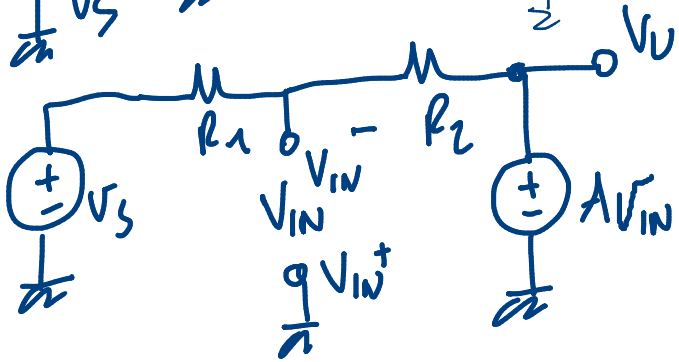
$$V_U \left[1 + \frac{A R_1}{R_1+R_2} \right] = A V_S$$

$$A_V = \frac{V_U}{V_S} = \frac{A}{1 + A \frac{R_1}{R_1+R_2}}$$

$$A \to +\infty \qquad A_V \to \frac{R_1+R_2}{R_1} = 1 + \frac{R_2}{R_1}$$







$$V' = \frac{V_1 R_2}{R_1+R_2} + \frac{V_2 R_1}{R_1+R_2}$$

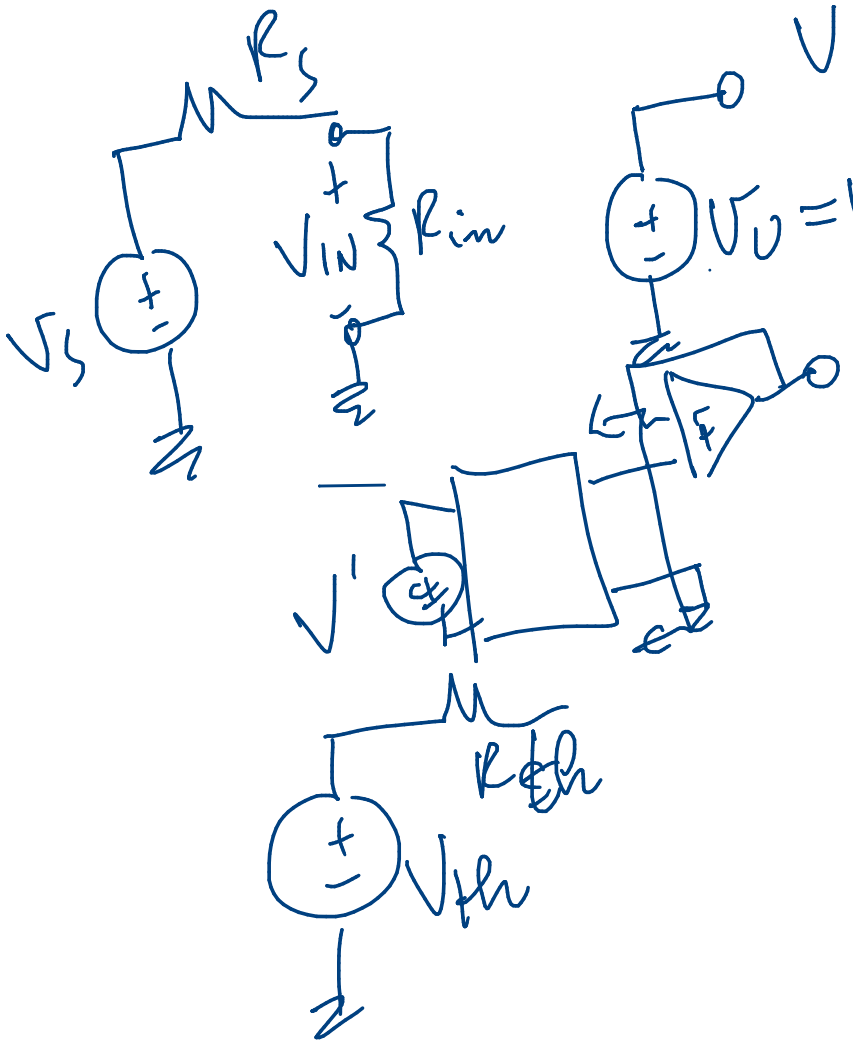
$$V_U = A V_{IN} \qquad V_{IN} = V_{IN}^+ - V_{IN}^-$$

$$V_{IN}^+ = 0 \qquad V_{IN}^- = V_S \frac{R_2}{R_1+R_2} + V_U \frac{R_1}{R_1+R_2}$$

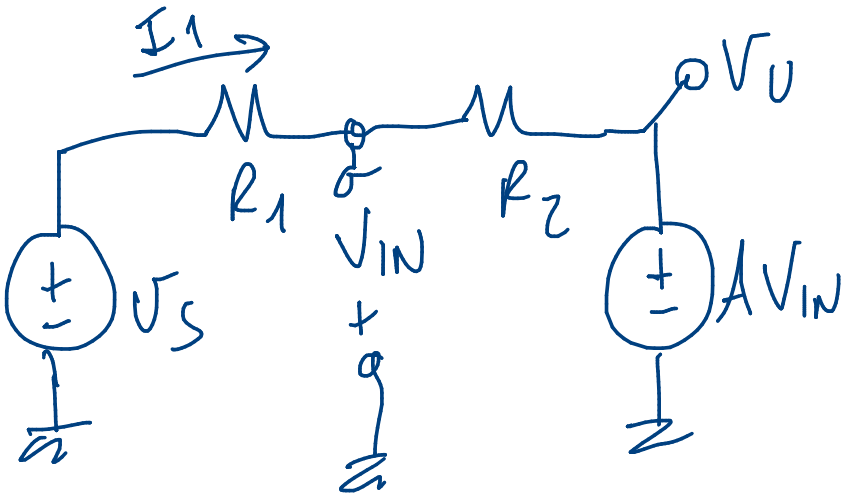
$$V_U = -A\left[\frac{V_S R_2}{R_1+R_2} + V_U \frac{R_1}{R_1+R_2}\right]$$

$$V_U\left[1 + \frac{A R_1}{R_1+R_2}\right] = -\frac{A R_2}{R_1+R_2} V_S$$

$$A_V = \frac{V_U}{V_S} = -\frac{A R_2}{R_1+R_2} \cdot \left[1 + \frac{A R_1}{R_1+R_2}\right]^{-1} \xrightarrow{A \to +\infty} A_V \to -\frac{R_2}{R_1}$$



$$V_U = \frac{R_{in}}{R_{in} + R_S} V_S$$



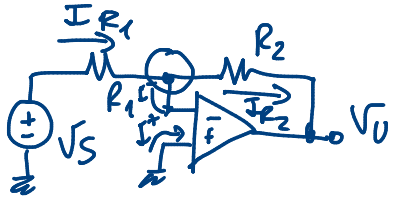
$$V_U = -\frac{R_2}{R_1} V_S$$

$$R_{IN} = \frac{V_S}{I_1}$$

$$I_1 = \frac{V_S - V_U}{R_1 + R_2}$$

$$I_1 = \frac{V_S + \frac{R_2}{R_1} V_S}{R_1 + R_2} = \frac{\frac{R_1 + R_2}{R_1} V_S}{R_1 + R_2} \Rightarrow I_1 = \frac{V_S}{R_1}$$

$$R_{IN} = R_1$$



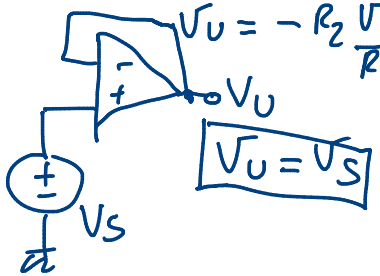
$$R_{V_S} = \frac{V_S}{I_{R_1}} = R_1$$

Per il CCV: $V_{IN}^+ \simeq V_{IN}^- \wedge I^+ \simeq 0 \; ; I^- \simeq 0$

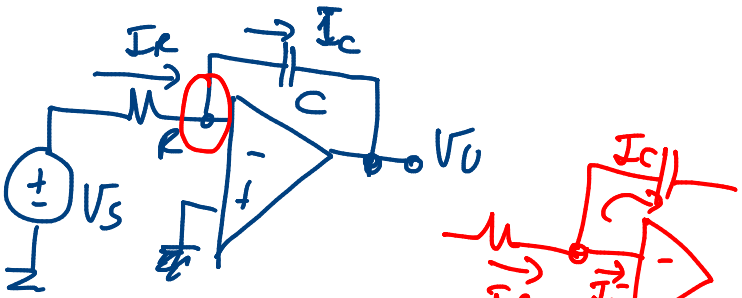
$$I_{R_1} = \frac{V_S}{R_1} \qquad I_{R_2} = I_{R_1} - I^- \simeq I_{R_1}$$

$$V_U = -R_2 I_{R_2}$$

$$V_U = -R_2 \frac{V_S}{R_1} \qquad A_V = \frac{V_U}{V_S} = -\frac{R_2}{R_1}$$



$$\boxed{V_U = V_S}$$



$I_C \simeq I_R$

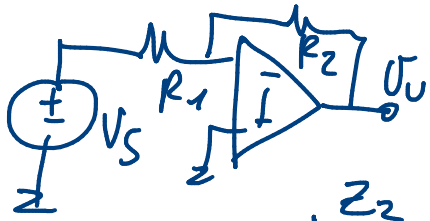
$I_C = I_R - I^-$

$I^- \simeq 0 \quad I_C \simeq I_R$

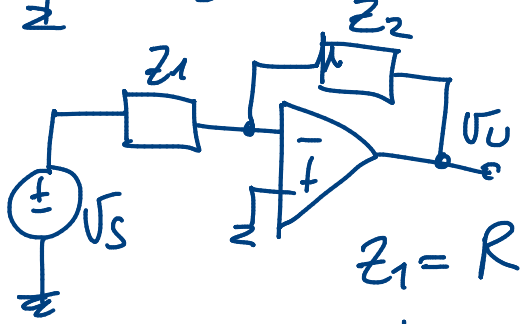
$$I_R = \frac{V_S}{R}$$

$$V_U = -\frac{1}{C}\int i_C(t)\,dt$$

$$V_U = -\frac{1}{RC}\int V_S(t)\,dt$$



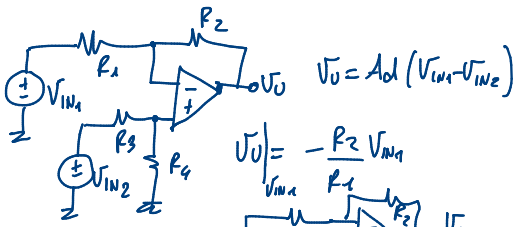
$$V_U = -\frac{R_2}{R_1} V_S$$



$$V_U = -\frac{Z_2}{Z_1} V_S$$

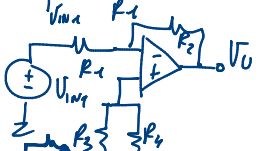
$$Z_1 = R \; ; \; Z_2 = \frac{1}{Cs}$$

$$V_U = -\frac{1}{RCs} V_S$$

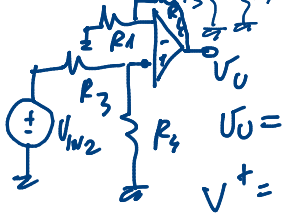


$V_U = A_d (V_{IN1} - V_{IN2})$

$V_U\big|_{V_{IN2}} = -\frac{R_2}{R_1} V_{IN1}$



$V_U\big|_{V_{IN2}} \Rightarrow$



$V_U = V^+ \left(1 + \frac{R_2}{R_1}\right)$

$V^+ = \frac{R_4}{R_3 + R_4} V_{IN2}$

$V_U\big|_{V_{IN2}} = \left(1 + \frac{R_2}{R_1}\right) \frac{R_4}{R_3 + R_4} V_{IN2}$

$V_U = -\frac{R_2}{R_1} V_{IN1} + \left(1 + \frac{R_2}{R_1}\right) \frac{R_4}{R_3 + R_4} V_{IN2} =$

$= -\frac{R_2}{R_1} V_{IN1} + \left(1 + \frac{R_2}{R_1}\right) \frac{\frac{R_4}{R_3} V_{IN2}}{1 + \frac{R_4}{R_3}}$

Se $\frac{R_2}{R_1} = \frac{R_4}{R_3} \Rightarrow$

$V_U = -\frac{R_2}{R_1} V_{IN1} + \frac{R_4}{R_3} V_{IN2} = -\frac{R_2}{R_1} (V_{IN1} - V_{IN2})$

$V_U = A_d (V_{IN1} - V_{IN2})$

$A_d = -\frac{R_2}{R_1}$