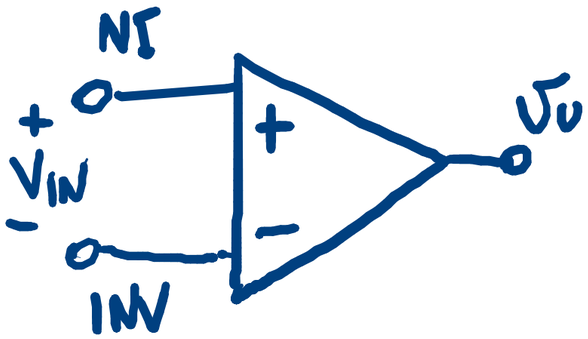
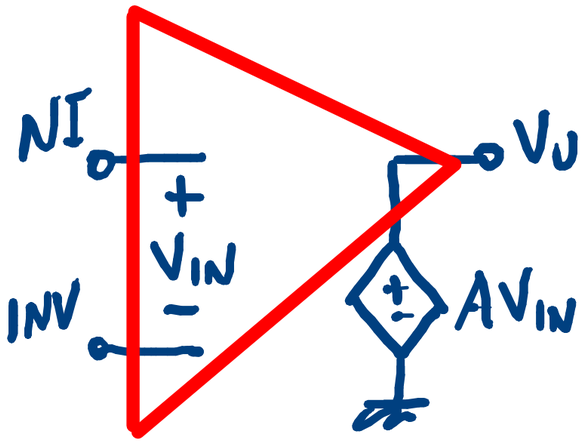
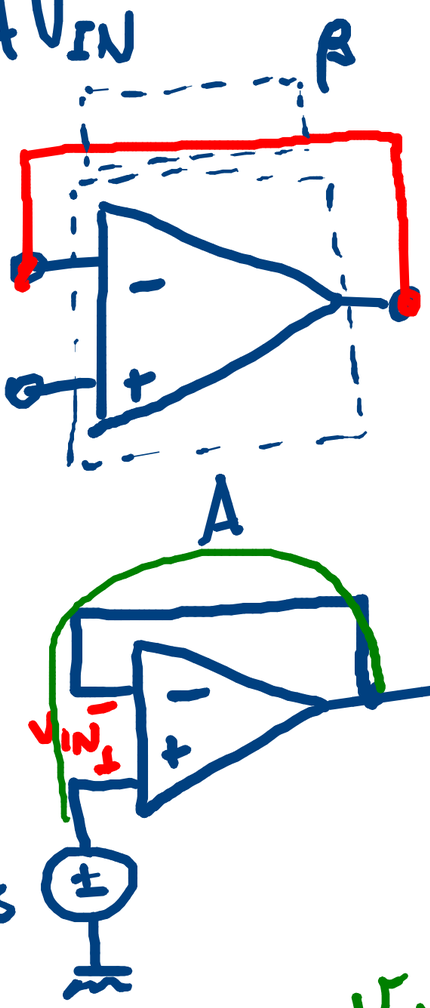
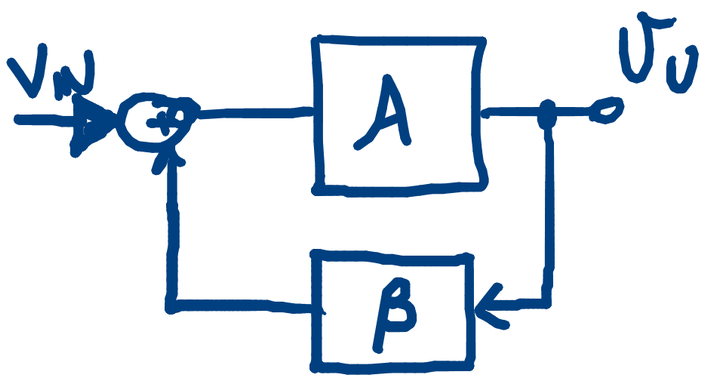




$$V_U = A V_{IN}$$





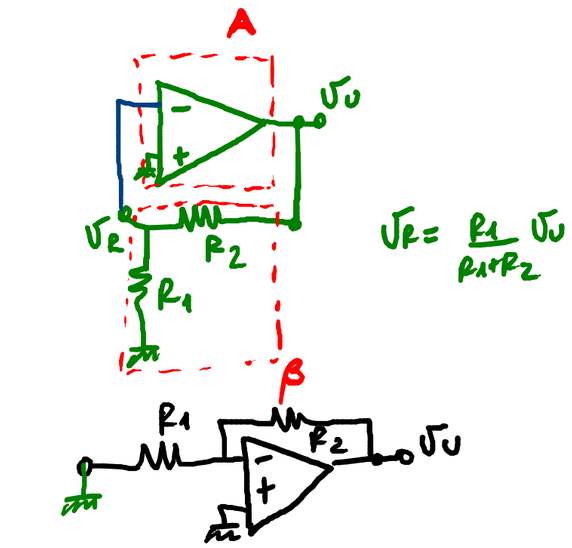
$$V_U = A V_{IN}$$

$$V_S = V_{IN} + V_U \Rightarrow V_{IN} = V_S - V_U$$

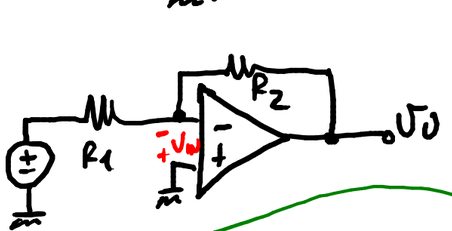
$$V_U = A(V_S - V_U) \Rightarrow$$

$$V_U(1+A) = A V_S$$

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



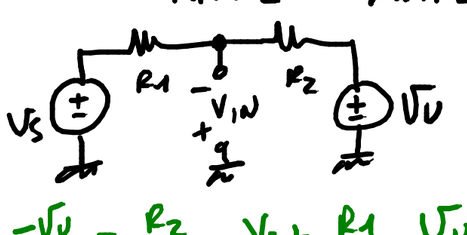
$$V_R = \frac{R_1}{R_1+R_2} V_U$$



$V_U = A V_{IN}$

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

$$\frac{V_U}{A} = V_{IN}$$



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

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

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

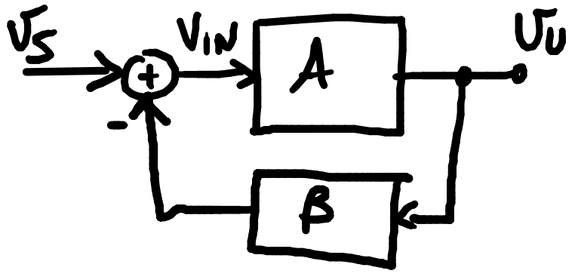
$$V_U = \frac{-\frac{A R_2}{R_1+R_2}}{\left(1 + A \frac{R_1}{R_1+R_2}\right)} V_S \simeq$$

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

$V_U = A V_{IN}$ $\quad V_{IN} = \frac{V_U}{A}$

$$V_{IN} = -\left[\frac{R_2}{R_1+R_2} \Big/ \left(1 + A \frac{R_1}{R_1+R_2}\right)\right] V_S$$

$V_{IN} \to 0$ se $A \to +\infty$



$$V_{IN} = V_S - \beta V_U$$

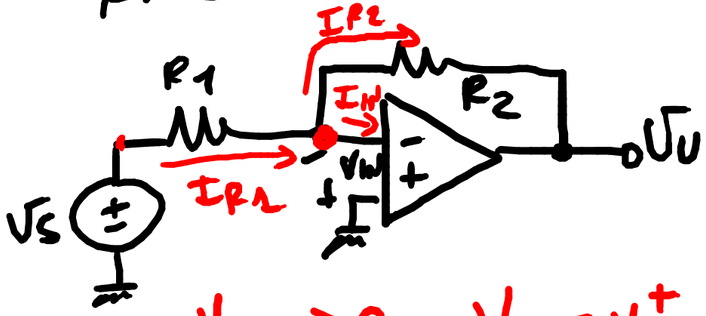
$$V_U = A V_{IN}$$

$$V_U = A(V_S - \beta V_U) \Rightarrow$$

$$V_U(1+\beta A) = A V_S \Rightarrow V_U = \frac{A}{1+\beta A} V_S$$

$$V_{IN} = \frac{V_U}{A} = \frac{1}{1+\beta A} V_S$$

$$\beta A \gg 1 \Rightarrow V_{IN} \to 0$$



$$V_{IN} \to 0 \qquad V_{IN} = V^+ - V^-$$

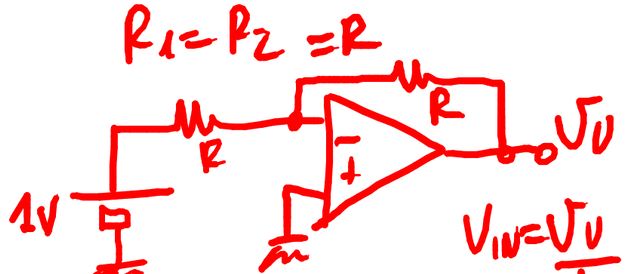
$$V^+ = 0V \Rightarrow V^- \simeq 0V$$

$$I_{R1} = \frac{V_S}{R_1}$$

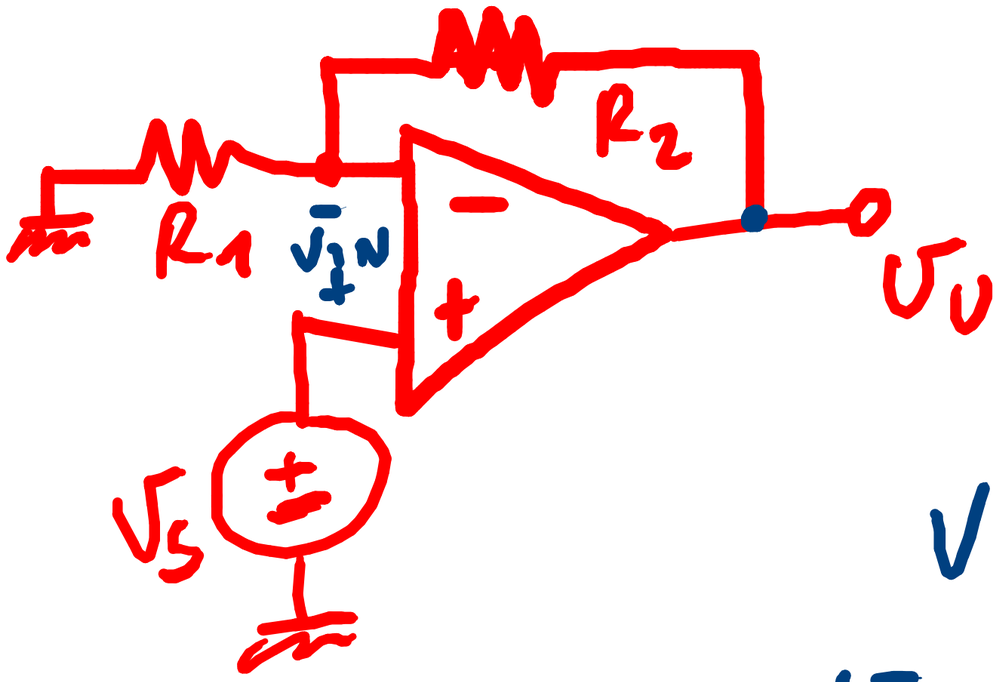
$$I_{R1} = I_{R2} + I_{IN} = I_{R1}$$

$$V_U = -R_2 I_{R2} = -R_2 I_{R1} = -\frac{R_2}{R_1} V_S$$

$R_1 = R_2 = R$



$$V_{IN} = \frac{V_U}{A} \xrightarrow{A=10^5} V_{IN} = 10\mu V$$



$$V_{IN} \simeq 0$$

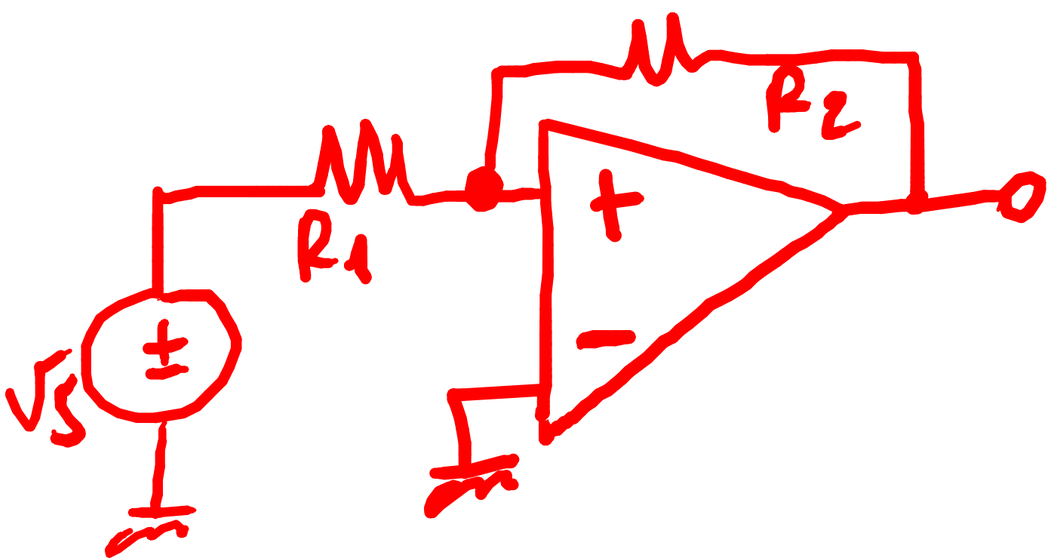
$$V^+ \simeq V^-$$

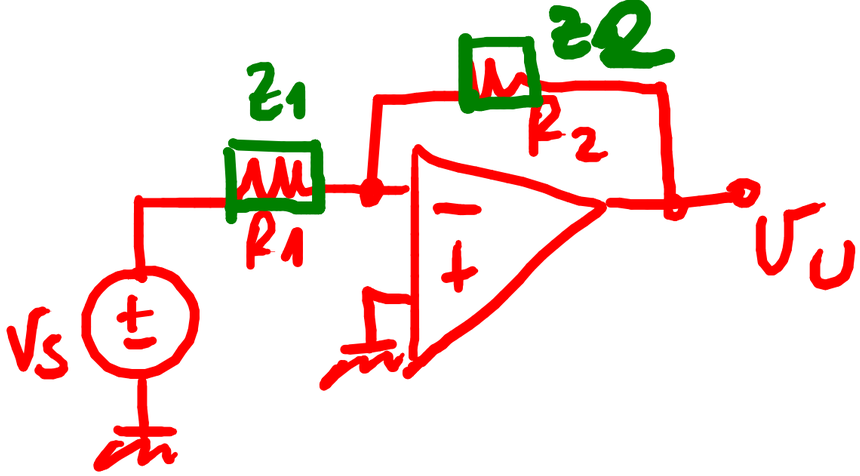
$$V^+ = V_S$$

$$V^- = V_S$$

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

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

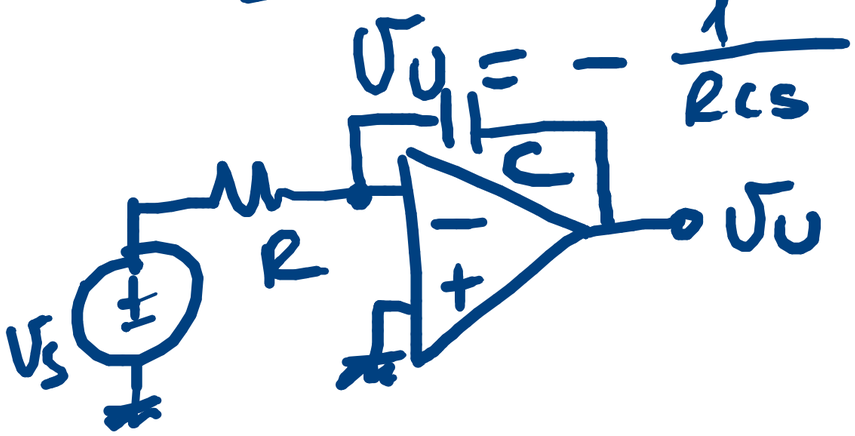




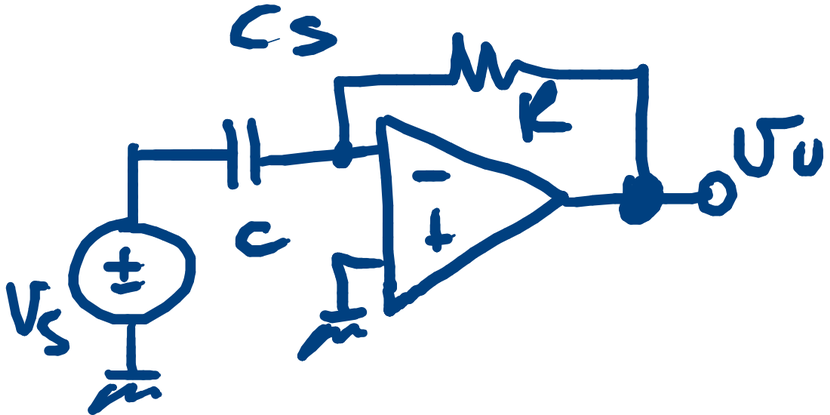
$$V_U = -\frac{Z_2}{Z_1} V_S$$

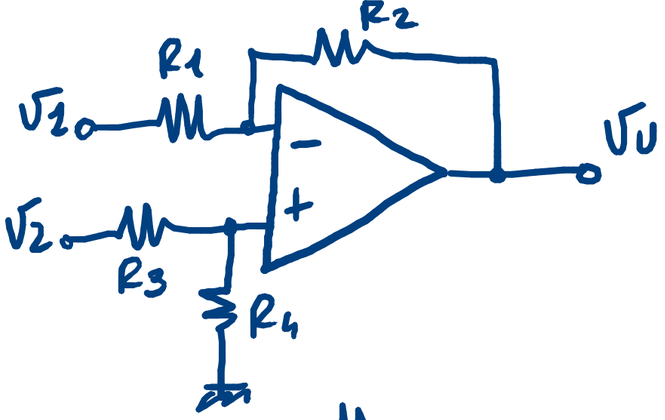
$$Z_2 = \frac{1}{Cs} \qquad Z_1 = R$$

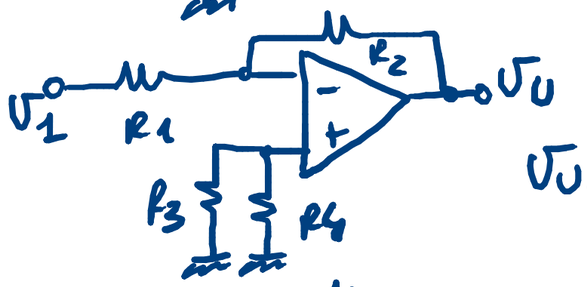
$$V_U = -\frac{1}{RCs} V_S$$



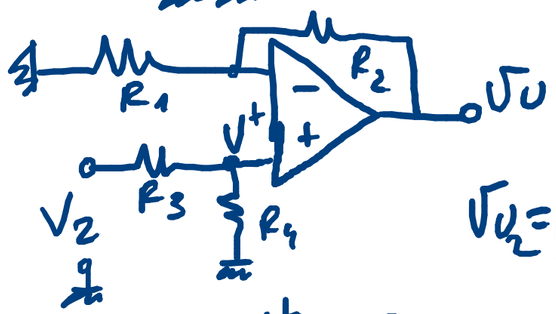
$$Z_1 = \frac{1}{Cs} \qquad Z_2 = R \quad \Rightarrow V_U = -RCs\, V_S$$







$$U_{U1} = -\frac{R_2}{R_1} U_1$$



$$U_{U2} = \left(1 + \frac{R_2}{R_1}\right) V^+$$

$$V^+ = \frac{R_4}{R_3 + R_4} V_2$$

$$U_{U2} = \frac{R_4}{R_3 + R_4} \left(1 + \frac{R_2}{R_1}\right) U_2$$

$$U_U = U_{U1} + U_{U2} = -\frac{R_2}{R_1} U_1 + \frac{R_4}{R_3 + R_4} \left(1 + \frac{R_2}{R_1}\right) U_2$$

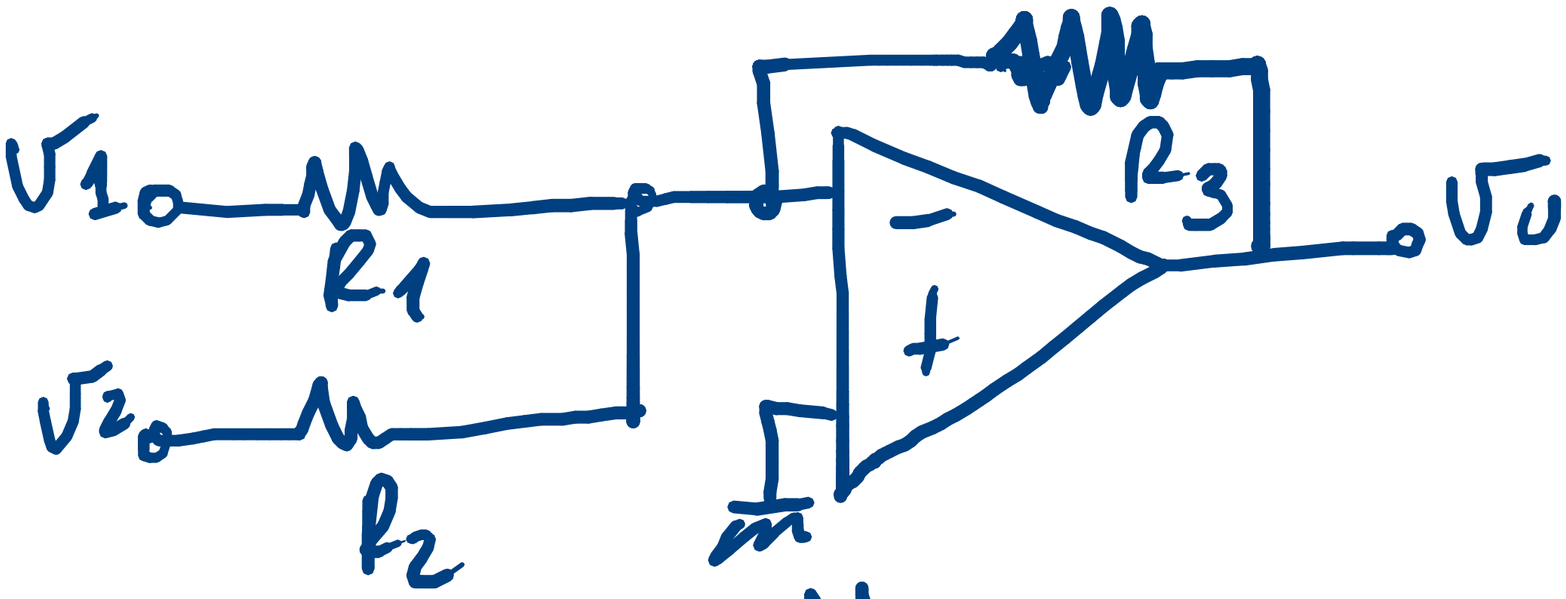
$$U_U = A_1 U_1 + A_2 U_2$$

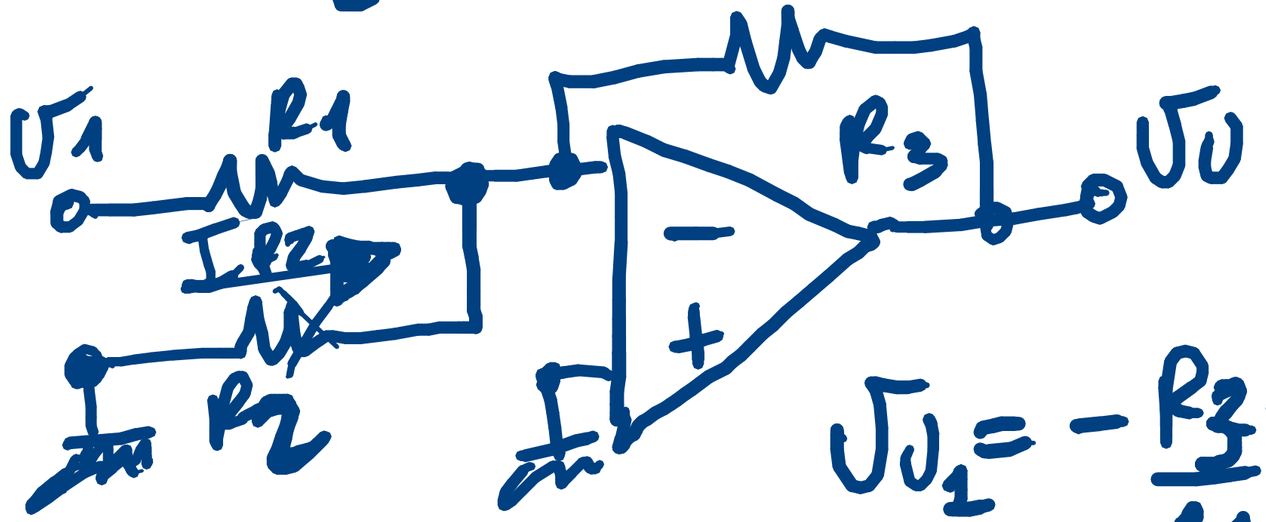
$$U_U = A_d (U_1 - U_2)$$

$$U_U = -\frac{R_2}{R_1} U_1 + \frac{R_4/R_3}{1 + \frac{R_4}{R_3}} \left(1 + \frac{R_2}{R_1}\right) U_2$$

$$\frac{R_2}{R_1} = R_4/R_3$$

$$\boxed{U_U = -\frac{R_2}{R_1} (U_1 - U_2)}$$





$$U_{U_1} = -\frac{R_3}{R_1} U_1$$

$$U_{U_2} = -\frac{R_3}{R_2} U_2$$

$$U_U = U_{U1} + U_{U2} = -\frac{R_3}{R_1} U_1 - \frac{R_3}{R_2} U_2$$