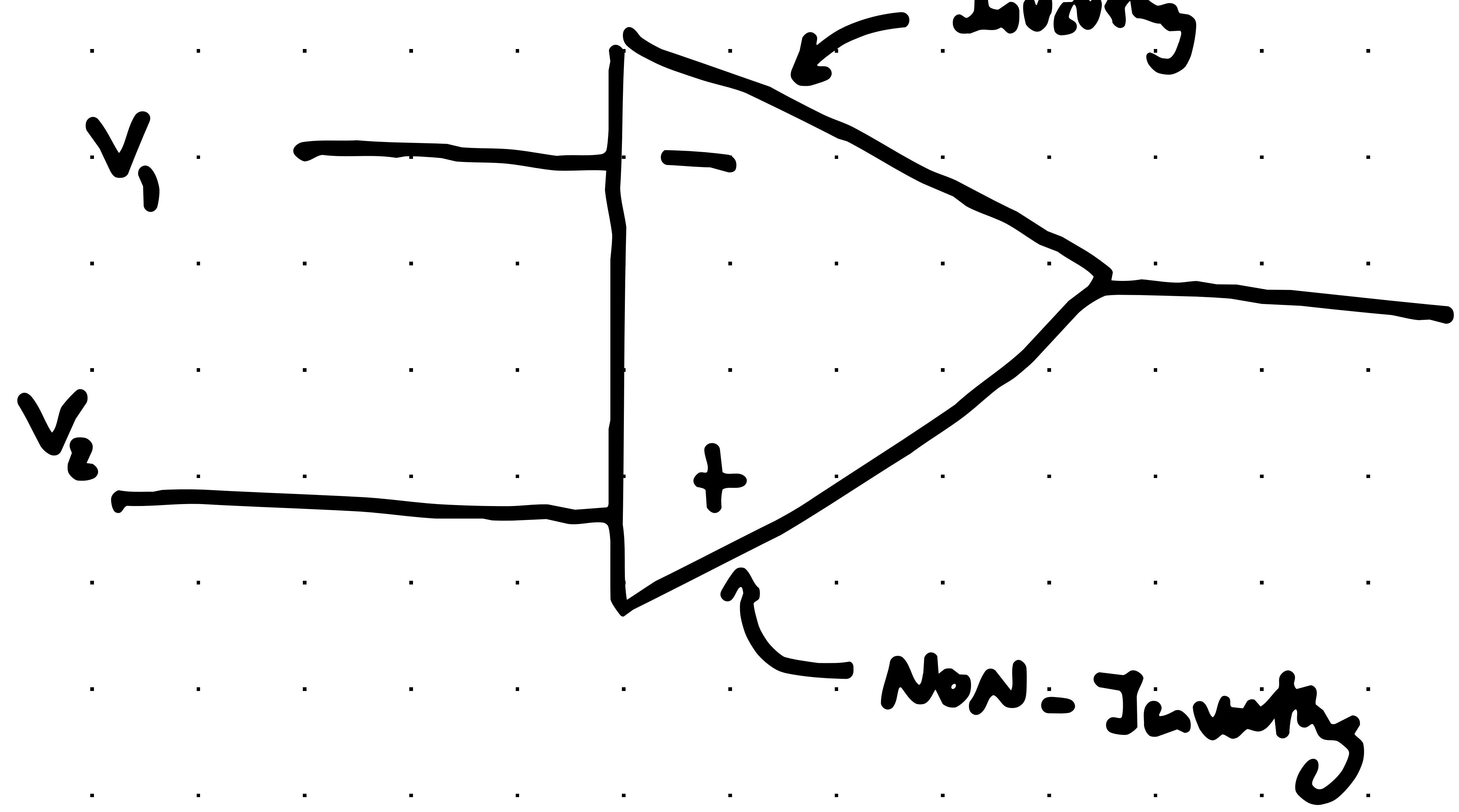
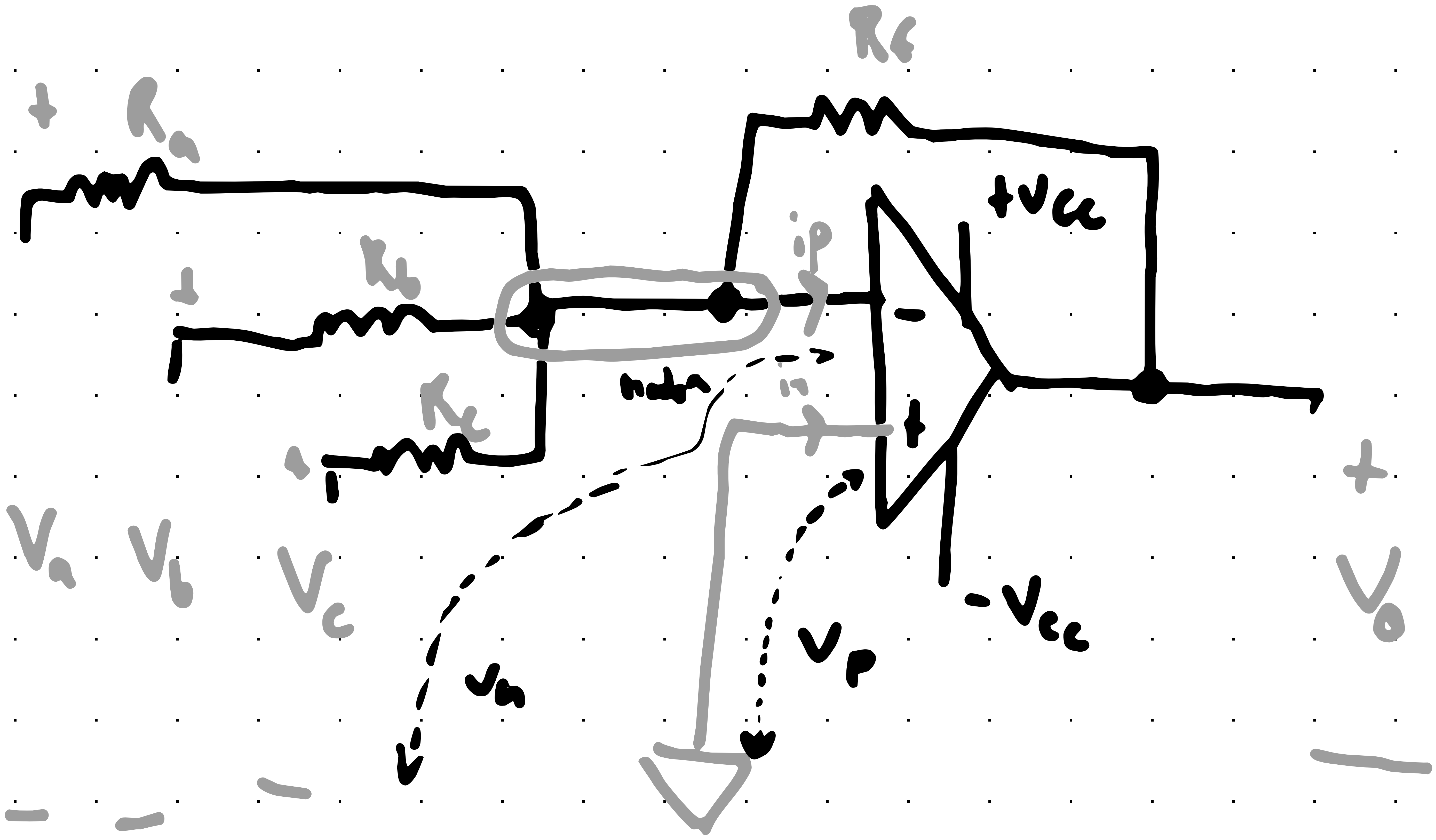
Lecture 13 ECED 2□□□

The Summing Amplifier Circuit





$$I_p = I_n = 0 , \quad V_p = V_n$$

$$\sum_{\text{Node}_1} I = 0 \quad \frac{V_1 - V_a}{R_a} + \frac{V_1 - V_b}{R_b} + \frac{V_1 - V_c}{R_c} + \frac{V_1 - V_0}{R_f}$$

$i_{in} = 0$

$$V_0 = -\left[\frac{R_f}{R_a} V_a + \frac{R_f}{R_b} V_b + \frac{R_f}{R_c} V_c\right]$$

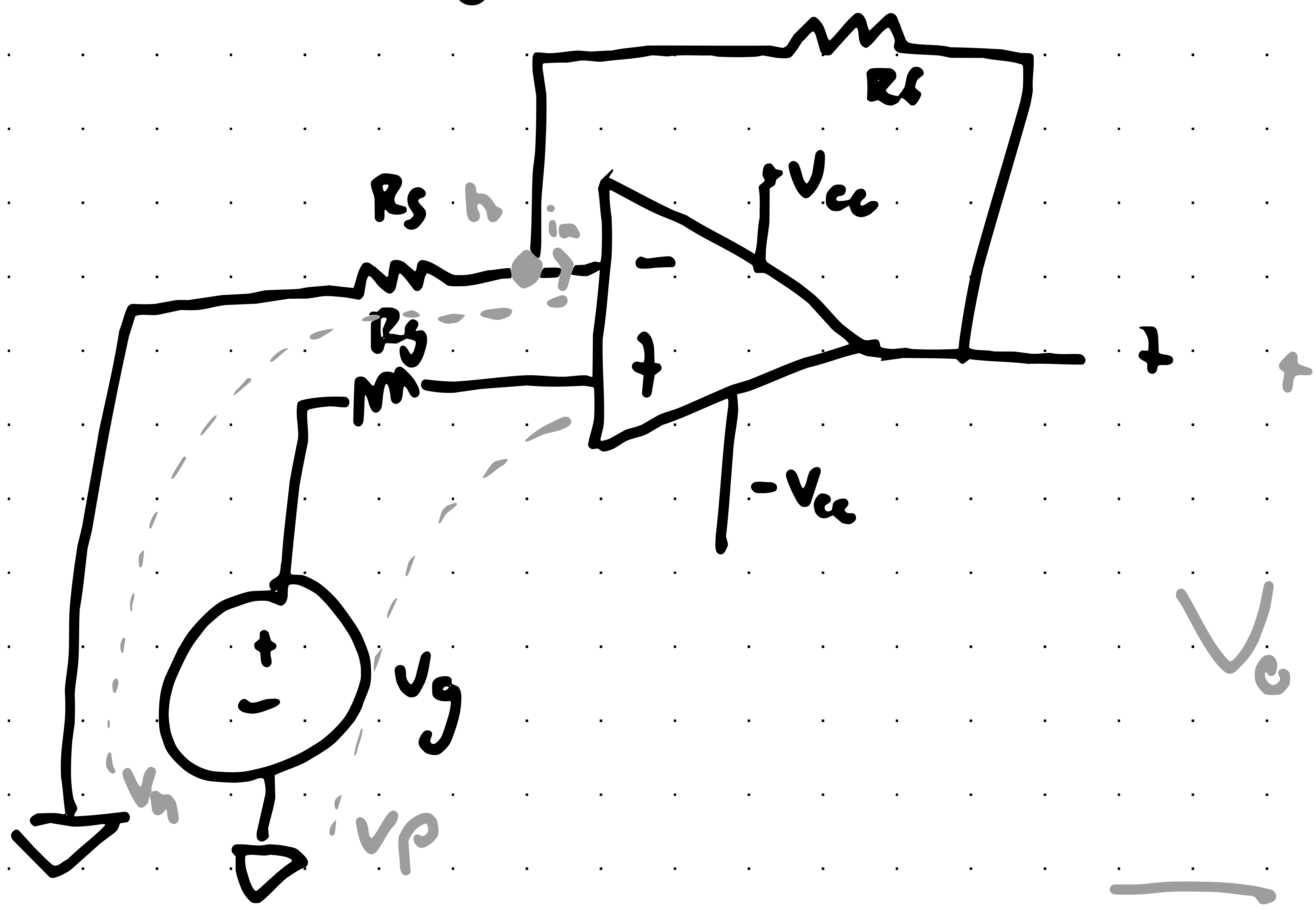
If $R_a = R_b = R_c = R_s$

$$\boxed{V_0 = -\left[\frac{R_f}{R_s} V_a + \frac{R_f}{R_s} V_b + \frac{R_f}{R_s} V_c\right]}$$

$$\boxed{V_0 = -\left[\frac{R_f}{R_s} (V_a + V_b + V_c)\right]}$$

Summing Inverting OPAMP

NON-Inverting Amplifier Circuit



$I_p = I_n = 0$

$V_n = V_p$

Since $V_p = V_g$, Then

$V_n = V_g$

$$\sum_{\text{node } n} I = 0 \qquad \frac{\overset{\to V_g}{V_n} - 0}{R_s} + \frac{\overset{\to V_g}{V_n} - V_o}{R_f} + \overset{\to 0}{i_n} = 0$$

$$\frac{V_g}{R_s} + \frac{V_n}{R_f} = 0$$

$$\frac{V_g}{R_s} + \frac{V_g}{R_f} - \frac{V_o}{R_f} = 0$$

$$\frac{V_o}{R_f} = V_g \left[\frac{1}{R_s} + \frac{1}{R_f} \right]$$

$$V_o = V_g \left[\frac{R_f}{R_s} + \cancelto{1}{\frac{R_f}{R_f}} \right]$$

$$V_o = V_g \left[\frac{R_f}{R_s} + 1 \right]$$

$$\boxed{V_o = V_g \left[\frac{R_f + R_s}{R_s} \right]}$$

<u>NON - Inverting</u> op-Amp