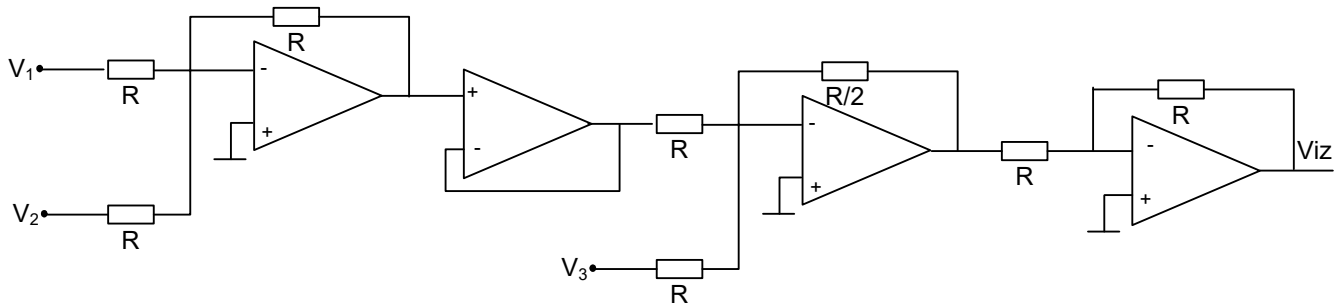


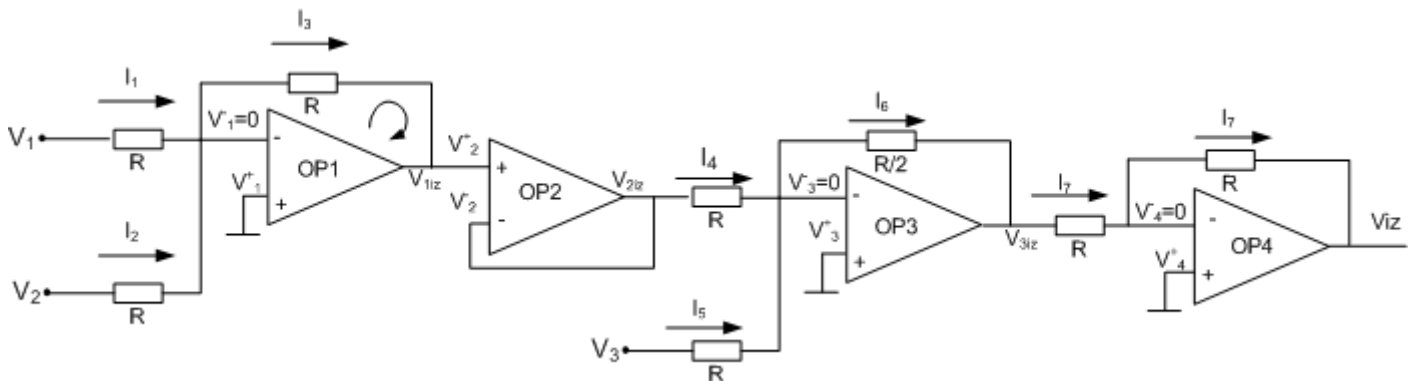
## VJEŽBA 6 (DIO 2)

**Zad. 1** Naći  $V_{iz}$  za datu šemu. Poznato je:  $V_1 = 1V$ ,  $V_2 = 2V$ ,  $V_3 = 2V$  i  $V_{CC} = 20V$ .



**Slika 1**

Rješenje:



**Slika 2**

**Za OP1**

$$\begin{aligned} V_1 - RI_1 &= 0 \\ V_1 &= RI_1 \\ I_1 &= \frac{V_1}{R} \\ V_2 - RI_2 &= 0 \\ V_2 &= RI_2 \\ I_2 &= \frac{V_2}{R} \\ I_3 &= I_1 + I_2 \\ I_3 &= \frac{V_1}{R} + \frac{V_2}{R} \\ I_3 &= \frac{V_1 + V_2}{R} \end{aligned}$$

$$0 - RI_3 = V_{1iz}$$

$$V_{1iz} = -RI_3 = -R\left(\frac{V_1 + V_2}{R}\right)$$

$$V_{1iz} = -V_1 - V_2$$

$$V_{1iz} = -1V - 2V$$

$$V_{1iz} = -3V \begin{cases} < 20V \\ > -20V \end{cases} \text{nema zasicenja}$$

**Za OP2**

$$V_2^+ = V_{1iz} = -V_1 - V_2$$

$$V_2^- = V_2^+ = -V_1 - V_2$$

$$V_{2iz} = V_2^- = -V_1 - V_2 = -3V$$

**Za OP3**

$$V_3^+ = 0V$$

$$V_3^- = V_3^+ = 0V$$

$$V_{2iz} - RI_4 = 0$$

$$-V_1 - V_2 - RI_4 = 0$$

$$-V_1 - V_2 = RI_4$$

$$I_4 = \frac{-V_1 - V_2}{R}$$

$$V_3 - RI_5 = 0$$

$$V_3 = RI_5$$

$$I_5 = \frac{V_3}{R}$$

$$I_6 = I_5 + I_4$$

$$I_6 = \frac{-V_1 - V_2}{R} + \frac{V_3}{R}$$

$$0 - \frac{R}{2} I_6 = V_{3iz}$$

$$V_{3iz} = -\frac{R}{2} \left( \frac{-V_1 - V_2}{R} + \frac{V_3}{R} \right)$$

$$V_{3iz} = -R \frac{1}{2R} (-V_1 - V_2 + V_3)$$

$$V_{3iz} = \frac{1}{2} (V_1 + V_2 - V_3)$$

$$V_{3iz} = \frac{1}{2} (1V + 2V - 2V)$$

$$V_{3iz} = 0.5V \begin{cases} < 20V \\ > -20V \end{cases}$$

$$V_4^+ = 0V$$

$$V_4^- = V_4^+ = 0V$$

$$V_{3iz} - RI_7 = 0$$

$$\frac{1}{2} (V_1 + V_2 - V_3) - RI_7 = 0$$

$$\frac{1}{2} (V_1 + V_2 - V_3) = RI_7$$

$$I_7 = \frac{\frac{1}{2} (V_1 + V_2 - V_3)}{R}$$

$$I_7 = \frac{V_1 + V_2 - V_3}{2R}$$

Struja  $I_7$  ne može proteći granom koja ulazi u OP4, pa sva nastavlja da protiče kroz otpornik koji povezuje “-“ ulaz OP4 i njegov izlaz. Krećemo od najbližeg poznatog napona,  $V_4^- = 0V$ , idemo ka  $V_{iz}$  i pišemo:

$$0 - RI_7 = V_{iz}$$

$$V_{iz} = -R \frac{V_1 + V_2 - V_3}{2R}$$

$$V_{iz} = -\frac{V_1 + V_2 - V_3}{2} = -\frac{1V + 2V - 2V}{2} = -0.5V \begin{cases} < 20V \\ > -20V \end{cases} \Rightarrow \text{nema zasicenja}$$