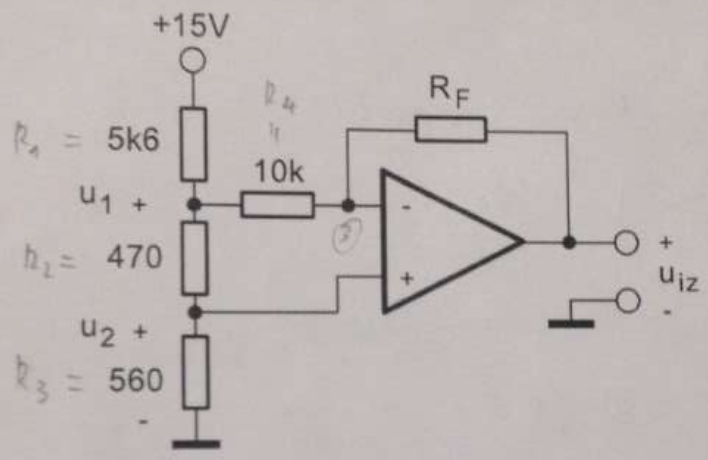
veze operacijsko pojačalo koristi se kao komparator.

Svrha vježbe je upoznavanje s integriranim operacijskim pojačalom, te njegove primjene u realizaciji invertirajućeg i neinvertirajućeg pojačala.

PRIPREMA

1. Proučiti poglavlje 10. iz skripte Elektronika 1, II dio, te proraditi zadatke koji se odnose na operacijska pojačala.
2. Za sklop na slici 1. odrediti U_{IZ}, U_1 i U_2 uz $R_F = 10$ kΩ i uz $R_F = 100$ kΩ. **Napisati opći izraz za U_{IZ} kao funkciju U_1 i U_2**, te dobivene brojčane rezultate upisati u tablicu 1.



Slika 1. Sklop s operacijskim pojačalom

Prostor za rješavanje:

$$0 = \frac{U_1 - U_{cc}}{R_1} + \frac{U_1 - U_2}{R_4} + \frac{U_1 - U_E}{R_3}$$

$$0 = \frac{U_2}{R_3} + \frac{U_2 - U_1}{R_2}$$

$$0 = \frac{U_3 - U_1}{R_4} + \frac{U_3 - U_{12}}{R_F}$$

$$U_3 = U_E$$

$$U_1\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_4}\right) = \frac{U_{cc}}{R_1} + U_2\left(\frac{1}{R_2} + \frac{1}{R_4}\right)$$

$$\frac{U_1}{R_2} = U_2\left(\frac{1}{R_3} + \frac{1}{R_2}\right)$$

$$\frac{U_{12}}{R_F} = U_2\left(\frac{1}{R_4} + \frac{1}{R_F}\right) - \frac{U_3}{R_4}$$

$$U_1 = U_2 \cdot R_2 \cdot \left(\frac{1}{R_3} + \frac{1}{R_2}\right) = U_2 \cdot \left(1 + \frac{R_2}{R_3}\right)$$

$$0 = \frac{U_2}{R_4} - \frac{U_{cc}}{R_1} + \frac{U_2}{R_4} - \frac{U_3}{R_4} + \frac{U_2}{R_2} - \frac{U_1}{R_2}$$

$$0 = \frac{U_2}{R_3} + \frac{U_2}{R_2} - \frac{U_1}{R_2}$$

$$0 = \frac{U_3}{R_4} - \frac{U_2}{R_4} + \frac{U_{12}}{R_F} - \frac{U_{12}}{R_F}$$

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

$$\left[\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_4} + \frac{R_2}{R_1 R_3} + \frac{R_2}{R_3 R_4} - \frac{1}{R_2} - \frac{1}{R_4}\right] \cdot U_2 = \frac{U_{cc}}{R_1}$$

$$\left[\frac{1}{R_1} + \frac{R_2}{R_1 R_3} + \frac{1}{R_3} + \frac{R_2}{R_1 R_4}\right] \cdot U_2 = \frac{U_{cc}}{R_1}$$

$$U_2 = U_{cc} \cdot \frac{1}{\left[1 + \frac{R_2}{R_3} + \frac{R_1}{R_2} + \frac{R_1 R_2}{R_3 R_4}\right]}$$

$$U_2 = 1.21\,V$$

$$U_1 = U_2 \cdot \left(1 + \frac{R_2}{R_3}\right) = 2.241\,V$$

$$U_{12} = U_2 \cdot \left(1 + \frac{R_F}{R_4}\right) - U_1 \cdot \frac{R_F}{R_4}$$

$$= U_2 \cdot \left(1 + \frac{R_F}{R_4}\right) - U_2 \cdot \left(1 + \frac{R_2}{R_3}\right) \frac{R_F}{R_4} =$$

$$= U_2 + U_2 \frac{R_F}{R_4} - U_2 \frac{R_F}{R_4} - U_2 \cdot \frac{R_2}{R_3} \cdot \frac{R_F}{R_4} =$$

$$= U_2 \cdot \left(1 - \frac{R_2}{R_3} \cdot \frac{R_F}{R_4}\right)$$

a) $R_F = 10\,k\Omega$

$$U_{12} = U_2 \cdot \left(1 - \frac{R_2}{R_3} \cdot \frac{R_F}{R_4}\right) = 0.196\,V$$

b) $R_F = 100\,k\Omega$

$$U_{12} = U_2 \cdot \left(1 - \frac{R_2}{R_3} \cdot \frac{R_F}{R_4}\right) =$$

Tablica 1. Rezultati

	$R_F = 10\ k\Omega$	$R_F = 100\ k\Omega$
U_1	2.241 V	2.241 V
U_2	1.218 V	1.218 V
U_{12}	0.196 V	−9.0045 V