

the average value of



45

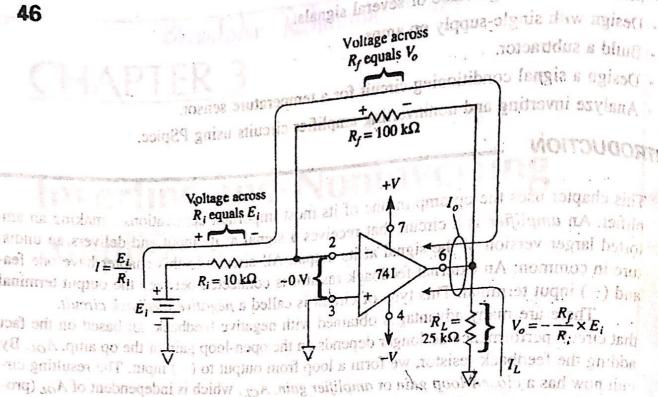


FIGURE 3-1 A positive input voltage is applied to the (-) input of an inverting amplifier. R_i converts this voltage to a current, I; R_f converts I back into an amplified version of E. The description of E. The open of the o

0 V, so ground potential is at the (-) input. For this reason, the (-) input is said to be at

a ting negative receback will show us to ignore changes in Age We be giff with the inventor amplifier to show that Act, depends

For Fig. 3-1, let $R_f = 100 \text{ k}\Omega$, $R_i = 10 \text{ k}\Omega$, and $E_i = 1 \text{ V}$. Calculate (a) I; (b) V_o ; (c) $\frac{A_{CL}}{A_v}$.

Solution (a) From Eq. (3-1a),

$$I = \frac{E_i}{R_i} = \frac{1 \text{ V}}{10 \text{ k}\Omega} = 0.1 \text{ mA}$$

(b) From Eq. (3-2a),

$$V_o = -\frac{R_f}{R_{i0}} \times (E_i) = -\frac{100 \text{ k}\Omega}{10 \text{ k}\Omega} (1 \text{ V}) = -10 \text{ V}$$

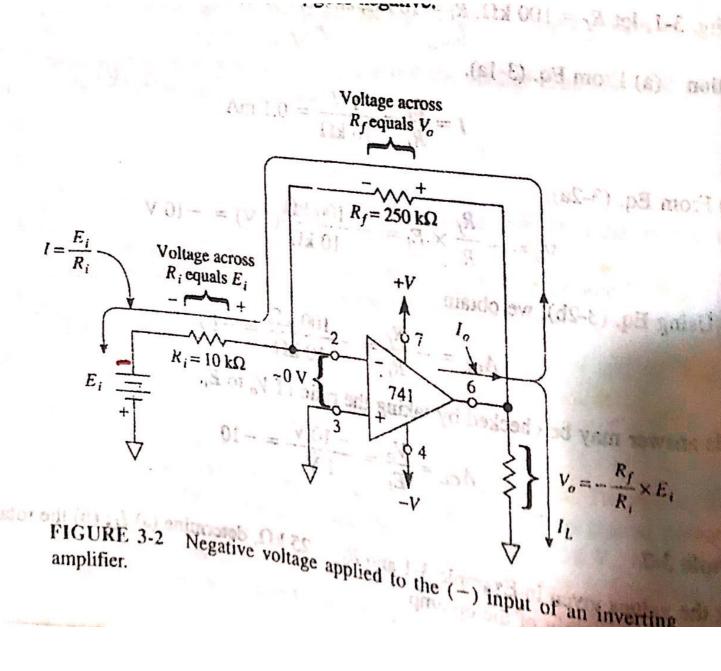
(c) Using Eq. (3-2b), we obtain

$$A_{CL} = -\frac{R_f}{R_i} = -\frac{100 \text{ k}\Omega}{10 \text{ k}\Omega} = -10$$

This answer may be checked by taking the ratio of V_o to E_i :

$$A_{CL} = \frac{V_o}{E_i} = \frac{-10 \text{ V}}{1 \text{ V}} = -10$$

Gin(AV) = Vout = -K



Example 3-3

versa. The equations developed in Section 3-1.2 are apply the to Fig. 3 For Fig. 3-2, let $R_f = 250 \text{ k}\Omega$, $R_i = 10 \text{ k}\Omega$, and $E_i = -0.5 \text{ V}$. Calculate (a) I; (b) the voltage across R_f ; (c) V_o .

input wate as shown in Fig. 3-3(b). That is when E is postave, V to

(a) From Eq. (3-1a), Solution

$$I = \frac{E_i}{R_i} = \frac{0.5 \text{ V}}{10 \text{ k}\Omega} = 50 \ \mu\text{A} = 0.05 \text{ mA}$$

(b) From Eq. (3-1b),
$$V_{R_f} = I \times R_f$$

$$= (50 \ \mu\text{A})(250 \ \text{k}\Omega)$$

$$= 12.5 \ \text{V}_{\text{AB}}$$

(c) From Eq. (3-2a),

$$V_o = -\frac{R_f}{R_i} \times E_i = -\frac{250 \text{ k}\Omega}{10 \text{ k}\Omega} (-0.5 \text{ V}) = +12.5 \text{ V}$$

Thus the magnitude of the output voltage does equal the voltage across R_f , and $A_{CL} = -25$.