Ch 2 (Op.Amp Applications) Problems

2.30 The inverting circuit with the T network in the feedback is redrawn in Fig. P2.30 in a way that emphasizes the observation that R_2 and R_3 in effect are in parallel (because the ideal op amp forces a virtual ground at the inverting input terminal). Use this observation to derive an expression for the gain (v_O/v_I) by first finding (v_X/v_I) and (v_O/v_X).

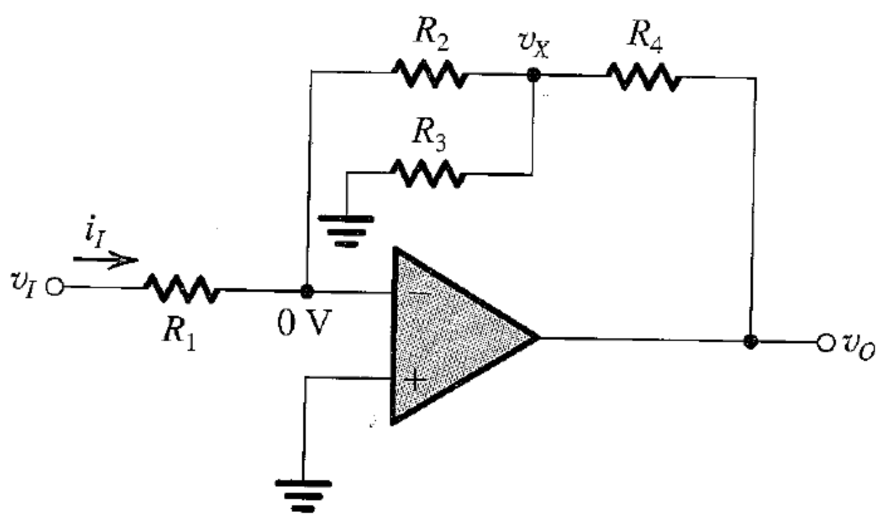
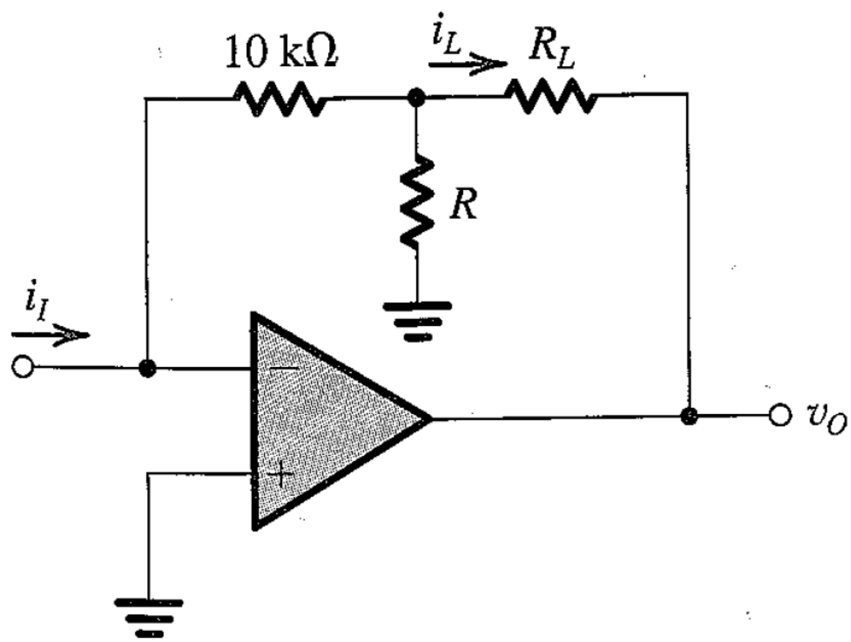


FIGURE P2.30

D2.33 Assuming the op amp to be ideal, it is required to design the circuit shown in Fig. P2.33 to implement a current amplifier with gain $i_L/i_I = 20$ A/A.

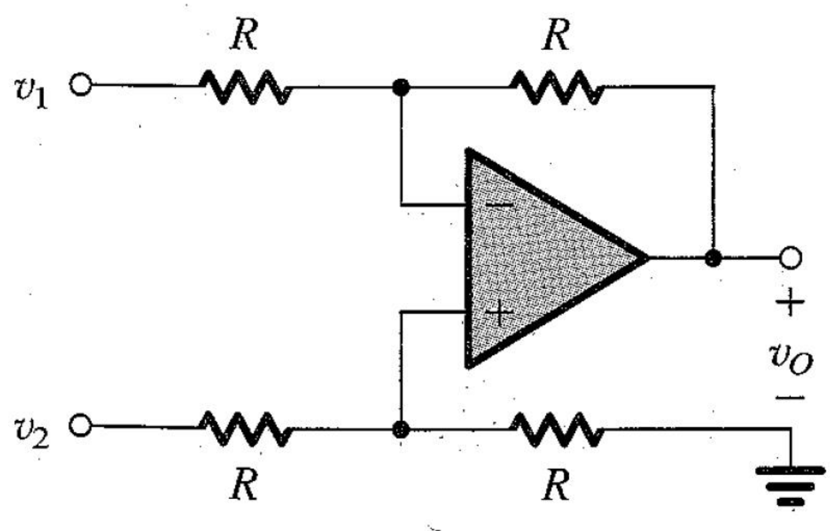
(a) Find the required value for R.
(b) If $R_L = 1\ \text{k}\Omega$ and the op amp operates in an ideal manner so long as v_O is in the range ± 12 V. What range of i_I is possible?
(c) What is the input resistance of the current amplifier? If the amplifier is fed with a current source having a current of 1 mA and a source resistance of 10 kΩ, find i_L.



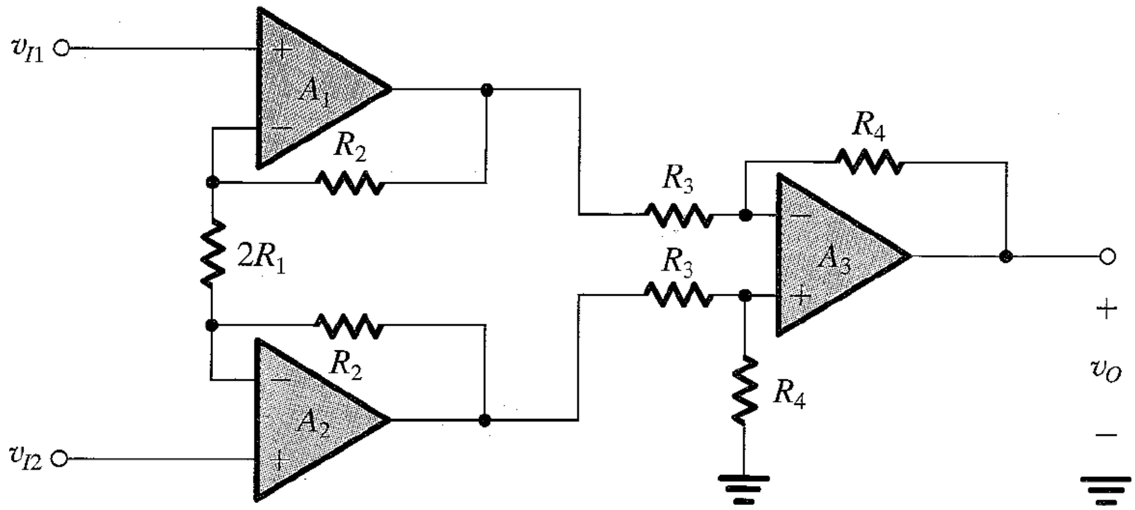
D2.41 Use two ideal op amps and resistors to implement the summing function.

$$v_O = v_1 + 2v_2 - 3v_3 - 4v_4$$

2.62 For the circuit shown in Fig. P2.62, express v_O as a function of v_1 and v_2. What is the input resistance seen by v_1 alone? By v_2 alone? By a source connected between the two input terminals? By a source connected to both input terminals simultaneously?



D2.76 Design the instrumentation-amplifier circuit of Fig. 2.20(b) to realize a differential gain, variable in the range 1 to 100, utilizing a 100-kΩ pot as variable resistor. (*Hint:* Design the second stage for a gain of 0.5.)


v_{I1}
A_1
R_2
$2R_1$
R_2
A_2
v_{I2}
R_4
R_3
R_3
A_3
R_4
+
v_O
−