2.26 Assume clockwise mesh currents for the circuit shown in Fig. P2.26 (below). Use mesh analysis to find these mesh currents.

2.27 For the circuit shown in Fig. P2.27, find v_o when the ideal amplifier (a) is an op amp, and (b) has finite gain A.

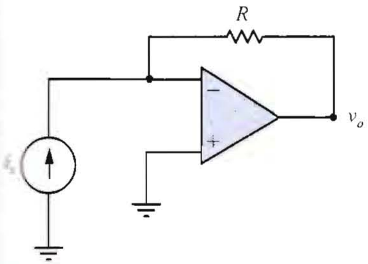

Fig. P2.27

2.28 For the op-amp circuit shown in Fig. P2.28, find (a) v_o, and (b) i_o.

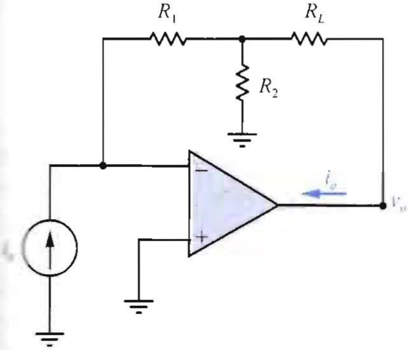

Fig. P2.28

2.29 For the op-amp circuit shown in Fig. P2.29, find (a) v_o, and (b) i_o.

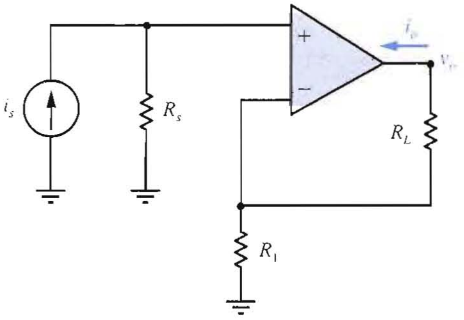

Fig. P2.29

2.30 The op-amp circuit shown in Fig. P2.30 is known as a **negative-impedance converter.** For this circuit, find (a) v_o, and (b) the resistance v_s/i_s.

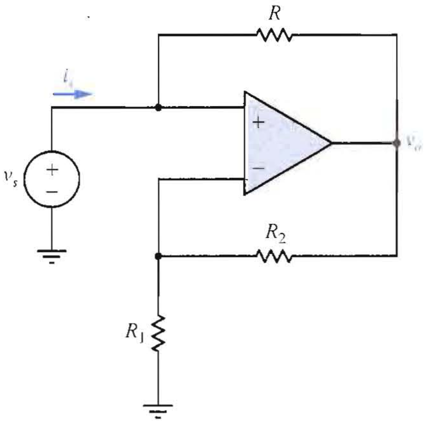

Fig. P2.30

2.31 For the op-amp circuit shown in Fig. P2.31, find (a) v_o, and (b) the resistance v_s/i_s. (See p. 104.)

2.32 For the op-amp circuit shown in Fig. P2.31, interchange the 1-Ω and 2-Ω resistors, and find (a) v_o, and (b) the resistance v_s/i_s. (See p. 104.)

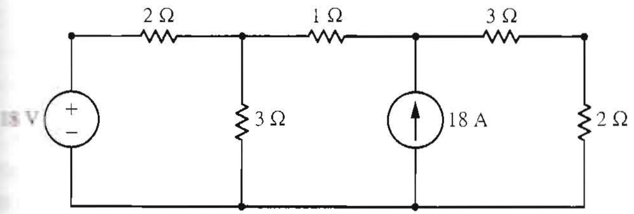

Fig. P2.26

4.54 For the circuit given in Fig. P4.24, when $\mathbf{V}_{s1} = 250\sqrt{2}\angle{-30°}$ V, $\mathbf{V}_{s2} = 250\sqrt{2}\angle{-90°}$ V, and $\mathbf{Z} = 78 - j45\ \Omega$, then $\mathbf{I}_1 = 6.8\angle{30°}$ A and $\mathbf{I}_2 =$ [illegible]$\angle{-90°}$ A. (a) Find the reactive power absorbed by each impedance. (b) Find the reactive power supplied by each source.

4.55 An R-ohm resistor has the voltage $v(t) = V_m \cos(\omega t + \phi_1)$ across it and it has the current $i(t) = I_m \cos(\omega t + \phi_2)$ through it. Show that the complex power absorbed by the resistor is given by

$$\mathbf{S}_R = \tfrac{1}{2}RI^2 = \tfrac{1}{2}V^2/R$$

4.56 An L-henry inductor has the voltage $v(t) = V_m \cos(\omega t + \phi_1)$ across it and it has the current $i(t) = I_m \cos(\omega t + \phi_2)$ through it. Show that the complex power absorbed by the inductor is given by

$$\mathbf{S}_L = \frac{j\omega L I^2}{2} = \frac{jV^2}{2\omega L}$$

4.57 An C-farad capacitor has the voltage $v(t) = V_m \cos(\omega t + \phi_1)$ across it and it has the current $i(t) = I_m \cos(\omega t + \phi_2)$ through it. Show that the complex power absorbed by the capacitor is given by

$$\mathbf{S}_C = \frac{-jI^2}{2\omega C} = \frac{-j\omega C V^2}{2}$$

4.58 For the single-phase, three-wire circuit shown in Fig. P4.58, suppose that $\mathbf{V}_s = 120\angle{0°}$ V rms. Find the average power supplied by each source if $\mathbf{Z}_1 = 60\ \Omega$, $\mathbf{Z}_2 = 80\ \Omega$, $\mathbf{Z}_3 = 40\ \Omega$, and $R_g = R_n = 0\ \Omega$.

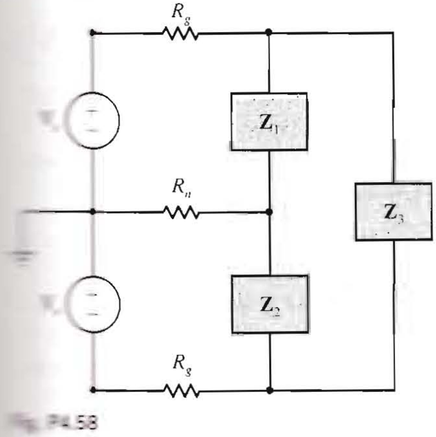

Fig. P4.58

4.59 For the single-phase, three-wire circuit shown in Fig. P4.58, suppose that $\mathbf{V}_s = 115\angle{0°}$ V rms. Find the average power supplied by each source if $\mathbf{Z}_1 = 60\ \Omega$, $\mathbf{Z}_2 = 80\ \Omega$, $\mathbf{Z}_3 = 40\ \Omega$, $R_g = 1\ \Omega$, and $R_n = 2\ \Omega$.

4.60 For the single-phase, three-wire circuit shown in Fig. P4.58, suppose that $R_g = R_n = 0\ \Omega$. For the case that $\mathbf{Z}_1$ absorbs 500 W at a lagging pf of 0.8, $\mathbf{Z}_2$ absorbs 1000 W at a lagging pf of 0.9, and $\mathbf{Z}_3$ absorbs 1500 W at a leading pf of 0.95, find the average power supplied by each source.

4.61 A balanced Y-Y three-phase circuit has 130-V rms phase voltages and a per-phase impedance of $\mathbf{Z} = 12 + j12\ \Omega$. Find the line currents and the total power absorbed by the load.

4.62 A balanced Y-Y three-phase circuit has 210-V rms, 60-Hz line voltages. Suppose that the load absorbs a total of 3 kW of power at a lagging pf of 0.85. (a) Find the per-phase impedance. (b) What value capacitors should be connected in parallel with the per-phase impedances to result in a unity pf (pf = 1)?

4.63 A balanced, three-phase Y-connected source, whose phase voltages are 115 V rms, has the unbalanced Y-connected load $\mathbf{Z}_{AN} = 3 + j4\ \Omega$, $\mathbf{Z}_{BN} = 10\ \Omega$, and $\mathbf{Z}_{CN} = 5 + j12\ \Omega$. Find the line currents and the total power absorbed by the load for the case that there is a neutral wire.

4.64 A balanced, three-phase Y-connected source, whose phase voltages are 120 V rms, has the unbalanced Y-connected load $\mathbf{Z}_{AN} = 10\ \Omega$, $\mathbf{Z}_{BN} = 20\ \Omega$, and $\mathbf{Z}_{CN} = 60\ \Omega$. Find the line currents and the total power absorbed by the load for the case that there is no neutral wire.

4.65 Suppose that the balanced Y-Δ three-phase circuit shown in Fig. 4.40 on p. 241 has a line voltage of 130 V rms and $\mathbf{Z} = 4\sqrt{2}\angle{45°}\ \Omega$. Find the line currents and the total power absorbed by the load.

4.66 A balanced, three-phase Y-connected source with 230-V rms line voltages has an unbalanced Δ-connected load whose impedances are $\mathbf{Z}_{AB} = 8\ \Omega$, $\mathbf{Z}_{BC} = 4 + j3\ \Omega$, and $\mathbf{Z}_{AC} = 12 - j5\ \Omega$. Find the