4.7 Connect a 5-Ω resistor in parallel with the inductor in the circuit shown in Fig. P4.6. Suppose that \( v_i(t) = 13 \cos(2t - 22.6^\circ) \) V. Find the voltage \( v_o(t) \) across the inductor by using voltage division. Draw a phasor diagram. Is this circuit a lag network or a lead network?

4.9 Connect a 5-Ω resistor in parallel with the inductor in the circuit shown in Fig. P4.8. Suppose that \( v_i(t) = 13 \cos(2t - 22.6^\circ) \) V. Find the voltage \( v_o(t) \) across the inductor by using nodal analysis. Draw a phasor diagram. Is this circuit a lag network or a lead network?

4.10 For the circuit given in Fig. P4.9, suppose that \( I_o(t) = 5 \cos 3t \) A. Find \( v_o(t) \) and \( v_i(t) \) by using current division.

4.14 For the RLC connection shown in Fig. P4.14, find the admittance \( Y \) when \( \omega \) is (a) 1, (b) 3, and (c) 7 rad/s.

4.15 Show that a general expression for the impedance \( Z \) depicted in Fig. P4.13 is

\[
Z = \frac{32}{\omega^2 + 16} + \frac{16(\omega^2 - 16)}{32(\omega^2 + 16)}
\]

4.16 Show that a general expression for the admittance \( Y \) depicted in Fig. P4.14 is

\[
Y = \frac{8(\omega^2 + 1)}{2(\omega^2 + 1) + 20(\omega^2 + 1)}
\]

4.17 For the circuit shown in Fig. P4.17, find the Thévenin equivalent of the circuit in the shaded box when \( v_i(t) = 4 \cos(\omega t - 60^\circ) \) V. Use this to determine \( v_o(t) \).

4.18 For the circuit shown in Fig. P4.18, find the Thévenin equivalent when \( v_i(t) = 4 \cos(\omega t - 60^\circ) \) V.

4.19 Find the frequency (in Hz) when the circuit shown in Fig. P4.19 has a resonance frequency of 1500 Hz.

4.20 The frequency of a circuit having \( V_i = 15^\circ \) V and \( V_o = 150^\circ \) V is 250 Hz. Find the corresponding circuit.

4.21 For the circuit shown in Fig. P4.21, find the Thévenin equivalent of the circuit when \( v_i(t) = 4 \cos(\omega t - 60^\circ) \) V.
4.28 For the RLC circuit shown in Fig. P4.28, suppose that $v_1(t) = 10 \cos 3t \ V$. Find the average power absorbed by the 4-Ω resistor for the case that (a) $C = \frac{1}{2} \ F$, (b) $C = \frac{2}{3} \ F$, (c) $C = \frac{3}{2} \ F$.

4.29 For the circuit shown in Fig. P4.29, suppose that $v_2(t) = 8 \cos 2t \ V$. Find the average power absorbed by each element in the circuit for the case that $Z_R = 1 \ \Omega$.

4.30 For the circuit shown in Fig. P4.29, change the value of the resistor to 2 Ω and the value of the capacitor to $\frac{1}{2} \ F$. Suppose that $v_2(t) = 8 \cos 2t \ V$. (a) Find the load impedance $Z_L$ that absorbs the maximum average power. (b) Replace the 4-Ω load resistor with a resistance $R_L$ that absorbs the maximum power for resistive loads, and determine this power.

4.31 For the op-amp circuit given in Fig. P4.21, when $v_1(t) = 6 \ cos \ 2t \ V$, then the output voltage $v_2(t) = 13.4 \ cos(2t - 117^\circ) \ V$. Find the average power absorbed by each element.

4.32 For the op-amp circuit given in Fig. P4.22, when $v_1(t) = 3 \ cos \ 2t \ V$, then the output voltage $v_2(t) = 10.6 \ cos(2t - 135^\circ) \ V$. Find the average power absorbed by each element.

4.33 For the op-amp circuit given in Fig. P4.23, when $v_1(t) = 4 \ cos(2t - 30^\circ) \ V$, then $v_2(t) = 1.6 \ cos(2t - 66.9^\circ) \ V$ and $v_3(t) = 1.6 \ cos(2t + 23.1^\circ) \ V$. Find the average power absorbed by each element.

4.34 For the circuit given in Fig. P4.24, when $V_o = 250V/\sqrt{2} / -30^\circ \ V$, $V_a = 250V/\sqrt{2} / -90^\circ \ V$, and $Z = 78 - j45 \ \Omega$, then $I_1 = 6.8/30^\circ \ A$ and $I_2 = 6.8/90^\circ \ A$. (a) Find the average power absorbed by each impedance. (b) Find the average power supplied by each source.

4.35 For the circuit given in Fig. P4.25, when $V_o = 250V/\sqrt{2} / -30^\circ \ V$, $V_a = 250V/\sqrt{2} / -90^\circ \ V$, and $Z = 26 - j15 \ \Omega$, then $I_1 = 6.8/30^\circ \ A$ and $I_2 = 6.8/90^\circ \ A$. (a) Find the average power absorbed by each impedance. (b) Find the average power supplied by each source.