Problem Set 7 (Fall 2011)

7.1 Determine the phase angles by which $v_1(t)$ leads $i_1(t)$ and $v_1(t)$ leads $i_2(t)$, where:

$v_1(t) = 6\sin(377t + 25°)\,\text{V}$

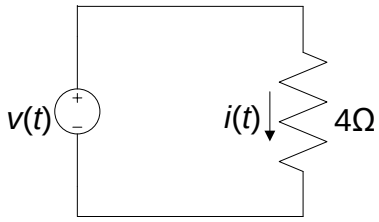
$i_1(t) = 0.04\cos(377t - 10°)\,\text{A}$

$i_2(t) = -0.2\sin(377t - 75°)\,\text{A}$

7.2 Calculate $i(t)$, the time-domain current in the resistor in the following circuit if the input voltage is:

a) $v_1(t) = 12\cos(377t + 180°)\,\text{V}$

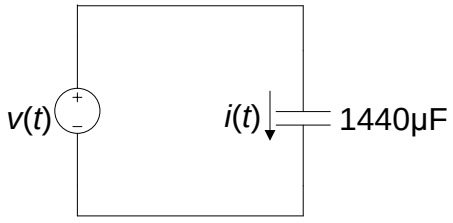
b) $v_2(t) = 16\sin(377t + 45°)\,\text{V}$



7.3 Calculate $i(t)$, the time-domain current in the capacitor shown in the following circuit if the voltage is:

a) $v_1(t) = 8\cos(377t - 30°)\,\text{V}$

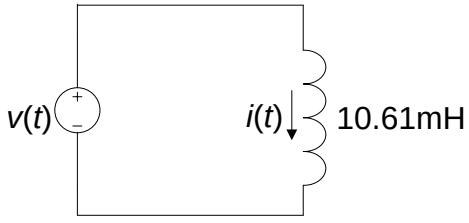
b) $v_2(t) = 4\sin(377t + 60°)\,\text{V}$



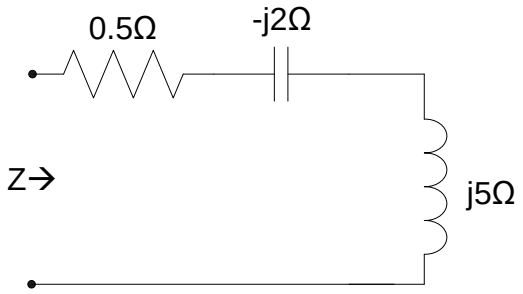
7.4 Calculate $i(t)$, the time-domain current in the inductor in the following circuit for the following voltage inputs:

a) $v_1(t) = 24\cos(377t + 12°)\,\text{V}$

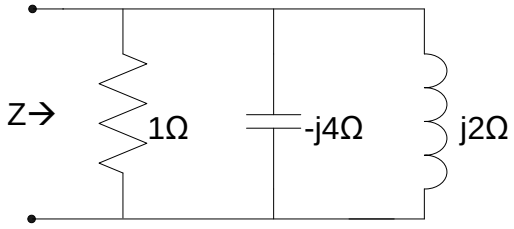
b) $v_2(t) = 18\sin(377t + 48°)\,\text{V}$



7.5 Find the frequency-domain impedance, Z, of the following network.

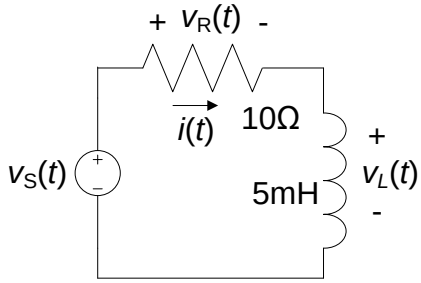


7.6 Find the frequency-domain impedance, Z, of the following circuit.



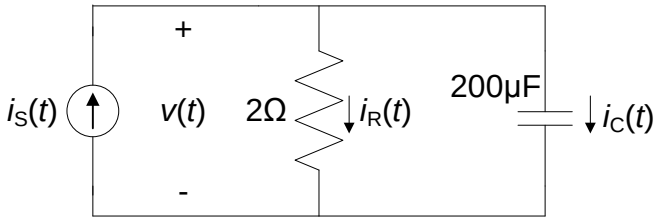
7.7 The voltages $v_R(t)$ and $v_L(t)$ in the following circuit can be drawn as phasors in a phasor diagram. Use a phasor diagram to show that $v_R(t) + v_L(t) = v_S(t)$ where:

$$v_s(t) = 120\cos(377t)\ \text{V}$$



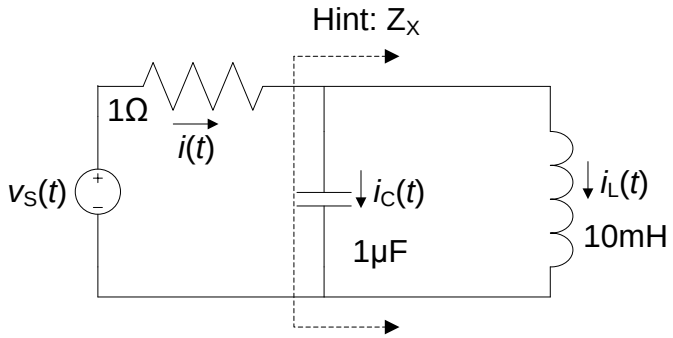
7.8 The current $i_R(t)$ and $i_C(t)$ in the following circuit can be drawn as phasors in a phasor diagram. Use such a phasor diagram to show that $i_R(t) + i_C(t) = i_S(t)$ where:

$$i_s(t) = 20\cos(377t + 30°)\ \text{A}$$



7.9 The currents $i_C(t)$ and $i_L(t)$ of the capacitor and inductor, respectively, in the following circuit can be drawn as phasors in a phasor diagram. Show in the phasor diagram that $i_L(t)+i_C(t)=i(t)$ where:

$$v_s(t) = 10\cos(10^3 t + 30°)\ \text{V}$$



7.10 Repeat 7.9 for $v_s(t) = 10\cos(10000t + 30°)$ V (surprising result called "resonance").