Solution of ECE 202 Test 3 S13

1. With reference to the partial circuit below,

   (a) Find the numerical average real power absorbed by the resistor. $P_R =$ ____________ W

   (b) The numerical impedance of the capacitor. $Z_C =$ ____________ $\angle$ ____________ ° Ω

   (c) The numerical phasor voltage across the capacitor. $V_C =$ ____________ $\angle$ ____________ ° V

   (d) Find the numerical apparent power absorbed by the capacitor. $P_{C,App} =$ ____________ VA

   (e) The numerical impedance of the inductor. $Z_L =$ ____________ $\angle$ ____________ ° Ω

   (f) The numerical phasor voltage across the inductor. $V_L =$ ____________ $\angle$ ____________ ° V

   (g) Find the numerical complex power absorbed by the inductor.

   $\mathbf{S}_L =$ ____________ $\angle$ ____________ ° VA

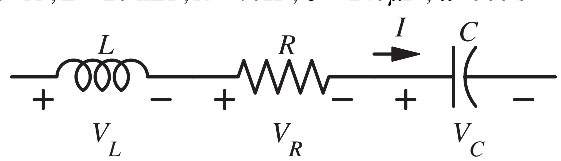
   (h) Find the time-domain current. $\mathrm{i}(t) =$ ____________________ A

   (i) Find the time-domain voltage across the inductor. $\mathrm{v}_L(t) =$ ____________________ V

   (j) Find the numerical instantaneous power absorbed by the inductor at time $t = 1\text{ ms}$.

   $p_L(1\text{ ms}) =$ ____________ W

$I = 4\angle 30°\text{ A}$, $L = 20\text{ mH}$, $R = 70\Omega$, $C = 240\mu\text{F}$, $\omega = 300\text{ s}^{-1}$



$$P_R = \frac{|I|^2}{2}R = \frac{4^2}{2}70 = 560\text{ W}$$

$$Z_C = \frac{1}{j\omega C} = \frac{1}{j300 \times 240 \times 10^{-6}} = 13.889\angle -90°\ \Omega$$

$$V_C = IZ_C = 4\angle 30° \times 13.889\angle -90° = 55.556\angle -60°\text{ V}$$

$$P_{C,App} = \frac{|V_C||I|}{2} = \frac{55.556 \times 4}{2} = 111.11\text{ VA}$$

$$Z_L = j\omega L = j300 \times 0.02 = 6\angle 90°\ \Omega$$

$$V_L = IZ_L = 4\angle 30° \times 6\angle 90° = 24\angle 120°\text{ V}$$

$$\mathbf{S}_L = \frac{V_L I_L^*}{2} = \frac{24\angle 120° \times 4\angle -30°}{2} = 48\angle 90°\text{ VA}$$

$$i(t) = 4\cos(300t + 30°) \text{ A}$$

$$v_L(t) = 24\cos(300t + 120°) \text{ V}$$

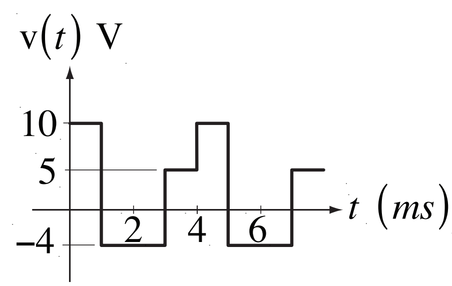
$$p_L(1 \text{ ms}) = i(1\text{ms}) \times v(1\text{ms}) = 4\cos(0.3 + 0.5236) \times 24\cos(0.3 + 2.0944) = 2.718 \times (-1.761) = -47.864 \text{ W}$$

2. With reference to the periodic voltage with period 4 ms graphed below,

(a) Find the numerical average voltage. v_{avg} = ____________ V

(b) Find the numerical average of the squared voltage. v_{avg}^2 = ____________ V^2
(This means square the voltage and then average it, not average the voltage and then square it.)

(c) Find the numerical effective value of the voltage. V_{eff} = ____________ V



$$v_{avg} = \frac{10 \times 1 - 4 \times 2 + 5 \times 1}{4} = 7/4 = 1.75 \text{ V}$$

$$v_{avg}^2 = \frac{100 \times 1 + 16 \times 2 + 25 \times 1}{4} = 157/4 = 39.25 \text{ V}^2$$

$$V_{eff} = \sqrt{v_{avg}^2} = \sqrt{39.25} = 6.265 \text{ V}$$

Solution of ECE 202 Test 3 S13

1. With reference to the partial circuit below,

   (a) Find the numerical average real power absorbed by the resistor. $P_R =$ ____________ W

   (b) The numerical impedance of the capacitor. $Z_C =$ ____________ $\angle$ ____________ ° Ω

   (c) The numerical phasor voltage across the capacitor. $V_C =$ ____________ $\angle$ ____________ ° V

   (d) Find the numerical apparent power absorbed by the capacitor. $P_{C,App} =$ ____________ VA

   (e) The numerical impedance of the inductor. $Z_L =$ ____________ $\angle$ ____________ ° Ω

   (f) The numerical phasor voltage across the inductor. $V_L =$ ____________ $\angle$ ____________ ° V

   (g) Find the numerical complex power absorbed by the inductor.

   $\mathbf{S}_L =$ ____________ $\angle$ ____________ ° VA

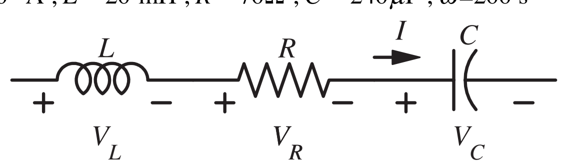
   (h) Find the time-domain current. $\mathrm{i}(t) =$ ____________________ A

   (i) Find the time-domain voltage across the inductor. $\mathrm{v}_L(t) =$ ____________________ V

   (j) Find the numerical instantaneous power absorbed by the inductor at time $t = 1$ ms .

   $p_L(1\text{ ms}) =$ ____________ W

$I = 5\angle -20°$ A , $L = 20$ mH , $R = 70\Omega$, $C = 240\mu$F , ω=200 s^{-1}



$$P_R = \frac{|I|^2}{2} R = \frac{5^2}{2} 70 = 875 \text{ W}$$

$$Z_C = \frac{1}{j\omega C} = \frac{1}{j200 \times 240 \times 10^{-6}} = 20.833\angle -90° \ \Omega$$

$$V_C = IZ_C = 5\angle -20° \times 20.833\angle -90° = 104.166\angle -110° \text{ V}$$

$$P_{C,App} = \frac{|V_C||I|}{2} = \frac{104.166 \times 5}{2} = 260.417 \text{ VA}$$

$$Z_L = j\omega L = j200 \times 0.02 = 4\angle 90° \ \Omega$$

$$V_L = IZ_L = 5\angle -20° \times 4\angle 90° = 20\angle 70° \text{ V}$$

$$\mathbf{S}_L = \frac{V_L I_L^*}{2} = \frac{20\angle 70° \times 5\angle 20°}{2} = 50\angle 90° \text{ VA}$$

$$i(t) = 5\cos(200t - 20°)\ \text{A}$$

$$v_L(t) = 20\cos(200t + 70°)\ \text{V}$$

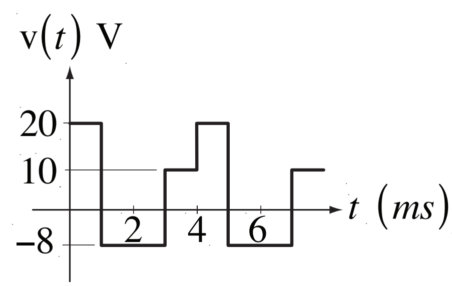
$$p_L(1\ \text{ms}) = i(1\text{ms}) \times v(1\text{ms}) = 5\cos(0.2 - 0.349) \times 20\cos(0.2 + 1.222) = 4.945 \times 2.965 = 14.662\ \text{W}$$

2. With reference to the periodic voltage with period 4 ms graphed below,

(a) Find the numerical average voltage. v_{avg} = ____________ V

(b) Find the numerical average of the squared voltage. v^2_{avg} = ____________ V^2
(This means square the voltage and then average it, not average the voltage and then square it.)

(c) Find the numerical effective value of the voltage. V_{eff} = ____________ V



$$v_{avg} = \frac{20 \times 1 - 8 \times 2 + 10 \times 1}{4} = 14 / 4 = 3.5\ \text{V}$$

$$v^2_{avg} = \frac{400 \times 1 + 64 \times 2 + 100 \times 1}{4} = 628 / 4 = 157\ \text{V}^2$$

$$V_{eff} = \sqrt{v^2_{avg}} = \sqrt{157} = 12.53\ \text{V}$$

Solution of ECE 202 Test 3 S13

1. With reference to the partial circuit below,

(a) Find the numerical average real power absorbed by the resistor. $P_R =$ ____________ W

(b) The numerical impedance of the capacitor. $Z_C =$ ____________ $\angle$ ____________ ° Ω

(c) The numerical phasor voltage across the capacitor. $V_C =$ ____________ $\angle$ ____________ ° V

(d) Find the numerical apparent power absorbed by the capacitor. $P_{C,App} =$ ____________ VA

(e) The numerical impedance of the inductor. $Z_L =$ ____________ $\angle$ ____________ ° Ω

(f) The numerical phasor voltage across the inductor. $V_L =$ ____________ $\angle$ ____________ ° V

(g) Find the numerical complex power absorbed by the inductor.

$\mathbf{S}_L =$ ____________ $\angle$ ____________ ° VA

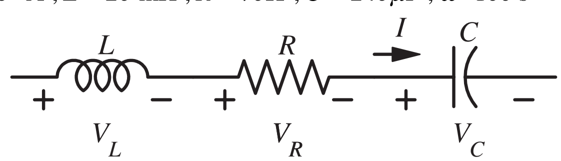
(h) Find the time-domain current. $\mathrm{i}(t) =$ ____________________ A

(i) Find the time-domain voltage across the inductor. $\mathrm{v}_L(t) =$ ____________________ V

(j) Find the numerical instantaneous power absorbed by the inductor at time $t = 1$ ms .

$p_L(1 \text{ ms}) =$ ____________ W

$I = 3\angle 50°$ A , $L = 20$ mH , $R = 70\Omega$, $C = 240\mu$F , ω=100 s^{-1}



$$P_R = \frac{|I|^2}{2} R = \frac{3^2}{2} 70 = 315 \text{ W}$$

$$Z_C = \frac{1}{j\omega C} = \frac{1}{j100 \times 240 \times 10^{-6}} = 41.667\angle -90° \ \Omega$$

$$V_C = IZ_C = 3\angle 50° \times 41.667\angle -90° = 125\angle -40° \text{ V}$$

$$P_{C,App} = \frac{|V_C||I|}{2} = \frac{125 \times 3}{2} = 187.5 \text{ VA}$$

$$Z_L = j\omega L = j100 \times 0.02 = 2\angle 90° \ \Omega$$

$$V_L = IZ_L = 3\angle 50° \times 2\angle 90° = 6\angle 140° \text{ V}$$

$$\mathbf{S}_L = \frac{V_L I_L^*}{2} = \frac{6\angle 140° \times 3\angle -50°}{2} = 9\angle 90° \text{ VA}$$

$$i(t) = 3\cos(100t + 50°) \text{ A}$$

$$v_L(t) = 6\cos(100t + 140°) \text{ V}$$

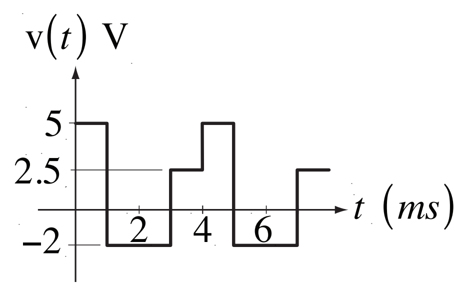
$$p_L(1 \text{ ms}) = i(1\text{ms}) \times v(1\text{ms}) = 3\cos(0.1 + 0.8727) \times 6\cos(0.1 + 2.443) = 1.689 \times (-4.957) = -8.372 \text{ W}$$

2. With reference to the periodic voltage with period 4 ms graphed below,

(a) Find the numerical average voltage. v_{avg} = ____________ V

(b) Find the numerical average of the squared voltage. v_{avg}^2 = ____________ V^2
(This means square the voltage and then average it, not average the voltage and then square it.)

(c) Find the numerical effective value of the voltage. V_{eff} = ____________ V



$$v_{avg} = \frac{5 \times 1 - 2 \times 2 + 2.5 \times 1}{4} = 7/8 = 0.875 \text{ V}$$

$$v_{avg}^2 = \frac{25 \times 1 + 4 \times 2 + 6.25 \times 1}{4} = 9.8125 \text{ V}^2$$

$$V_{eff} = \sqrt{v_{avg}^2} = \sqrt{9.8125} = 3.1325 \text{ V}$$