Solution of ECE 300 Test 10 S09

1. In the partial circuit below I is the phasor form of $\mathrm{i}(t)$, I_C is the phasor form of $\mathrm{i}_C(t)$ and V is the phasor form of $\mathrm{v}(t)$. Find the numerical values of I_C and V in magnitude-angle form (angle in degrees).

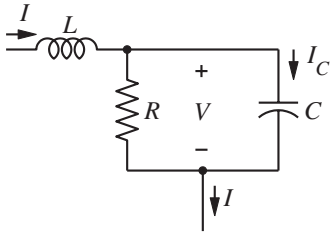
$\omega = 200$

$$I_C = \frac{R}{R + 1/\,j\omega C} I = \frac{100}{100 + 1/\left(j200 \times 30 \times 10^{-6}\right)} 3\angle 0° = \frac{100}{100 - j166.67} 3\angle 0°$$

$$I_C = \frac{100}{194.37\angle -59.04°} 3\angle 0° = 1.5434\angle 59.04°$$

$$V = I_C \times 1/\,j\omega C = 1.5434\angle 59.04° \times \left(166.67\angle -90°\right) = 257.24\angle -30.96°$$

$\mathrm{i}(t) = 3\cos(200t)$, $R = 100\Omega$, $C = 30\mu\mathrm{F}$



2. In each part below find which current or voltage is leading the other and by how many degrees. The angle you report should be a positive angle between $0°$ and $180°$.

(a) $\mathrm{v}_1(t) = -4\cos(50t - 30°)$, $\mathrm{v}_2(t) = 3\sin(50t)$

$$\mathrm{v}_1(t) = 4\cos(50t + 150°) \ , \ \mathrm{v}_2(t) = 3\cos(50t - 90°)$$

The phase-angle difference is $150° - (-90°) = 240° > 180°$. An equivalent phase-angle difference is $240° - 360° = -120°$. So v_1 leads v_2 by $-120°$ or v_2 leads v_1 by $+120°$.

(b) $\mathrm{i}_1(t) = 8\cos(2000t + 100°)$, $\mathrm{i}_2(t) = -3\sin(2000t + 20°)$

$$\mathrm{i}_1(t) = 8\cos(2000t + 100°) \ , \ \mathrm{i}_2(t) = 3\sin(2000t - 160°)$$

$$\mathrm{i}_1(t) = 8\cos(2000t + 100°) \ , \ \mathrm{i}_2(t) = 3\cos(2000t - 250°)$$

The phase-angle difference is $100° - (-250°) = 350° > 180°$. An equivalent phase-angle difference is $350° - 360° = -10°$. So i_1 leads i_2 by $-10°$ or i_2 leads i_1 by $+10°$.

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1. In the partial circuit below I is the phasor form of $\mathrm{i}(t)$, I_C is the phasor form of $\mathrm{i}_C(t)$ and V is the phasor form of $\mathrm{v}(t)$. Find the numerical values of I_C and V in magnitude-angle form (angle in degrees).

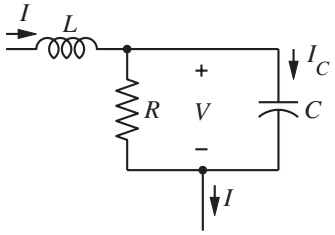
$\omega = 100$

$$I_C = \frac{R}{R + 1/\,j\omega C} I = \frac{100}{100 + 1/\left(j100 \times 30 \times 10^{-6}\right)} 3\angle 0° = \frac{100}{100 - j333.33} 3\angle 0°$$

$$I_C = \frac{100}{348.007\angle -73.3°} 3\angle 0° = 0.8621\angle 73.3°$$

$$V = I_C \times 1/\,j\omega C = 0.8621\angle 73.3° \times \left(333.33\angle -90°\right) = 287.36\angle -16.7°$$

$\mathrm{i}(t) = 3\cos(100t)$, $R = 100\Omega$, $C = 30\mu\mathrm{F}$



2. In each part below find which current or voltage is leading the other and by how many degrees. The angle you report should be a positive angle between $0°$ and $180°$.

(a) $\mathrm{v}_1(t) = -4\cos(50t - 80°)$, $\mathrm{v}_2(t) = 3\sin(50t)$

$$\mathrm{v}_1(t) = 4\cos(50t + 100°) \ , \ \mathrm{v}_2(t) = 3\cos(50t - 90°)$$

The phase-angle difference is $100° - (-90°) = 190° > 180°$. An equivalent phase-angle difference is $190° - 360° = -170°$. So v_1 leads v_2 by $-170°$ or v_2 leads v_1 by $+170°$.

(b) $\mathrm{i}_1(t) = 8\cos(2000t + 100°)$, $\mathrm{i}_2(t) = -3\sin(2000t - 50°)$

$$\mathrm{i}_1(t) = 8\cos(2000t + 100°) \ , \ \mathrm{i}_2(t) = 3\sin(2000t + 130°)$$

$$\mathrm{i}_1(t) = 8\cos(2000t + 100°) \ , \ \mathrm{i}_2(t) = 3\cos(2000t + 40°)$$

The phase-angle difference is $100° - 40° = 60°$. So i_1 leads i_2 by $60°$.

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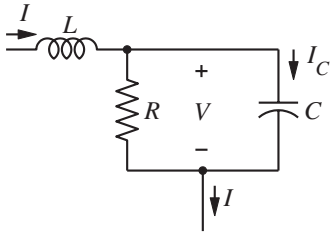
$\omega = 300$

$$I_C = \frac{R}{R + 1/\,j\omega C} I = \frac{100}{100 + 1/\left(j300 \times 30 \times 10^{-6}\right)} 3\angle 0° = \frac{100}{100 - j111.11} 3\angle 0°$$

$$I_C = \frac{100}{149.48\angle -48.01°} 3\angle 0° = 2.007\angle 48.01°$$

$$V = I_C \times 1/\,j\omega C = 2.007\angle 48.01° \times \left(111.11\angle -90°\right) = 223\angle -41.99°$$

$\mathrm{i}(t) = 3\cos(300t)$, $R = 100\Omega$, $C = 30\mu\mathrm{F}$



2. In each part below find which current or voltage is leading the other and by how many degrees. The angle you report should be a positive angle between $0°$ and $180°$.

(a) $\mathrm{v}_1(t) = -4\cos(50t - 60°)$, $\mathrm{v}_2(t) = 3\sin(50t)$

$$\mathrm{v}_1(t) = 4\cos(50t + 120°) \text{ , } \mathrm{v}_2(t) = 3\cos(50t - 90°)$$

The phase-angle difference is $120° - (-90°) = 210° > 180°$. An equivalent phase-angle difference is $210° - 360° = -150°$. So v_1 leads v_2 by $-150°$ or v_2 leads v_1 by $+150°$.

(b) $\mathrm{i}_1(t) = 8\cos(2000t + 100°)$, $\mathrm{i}_2(t) = -3\sin(2000t + 70°)$

$$\mathrm{i}_1(t) = 8\cos(2000t + 100°) \text{ , } \mathrm{i}_2(t) = 3\sin(2000t - 110°)$$

$$\mathrm{i}_1(t) = 8\cos(2000t + 100°) \text{ , } \mathrm{i}_2(t) = 3\cos(2000t - 200°)$$

The phase-angle difference is $100° - (-200°) = 300° > 180°$. An equivalent phase-angle difference is $300° - 360° = -60°$. So i_1 leads i_2 by $-60°$ or i_2 leads i_1 by $+60°$.