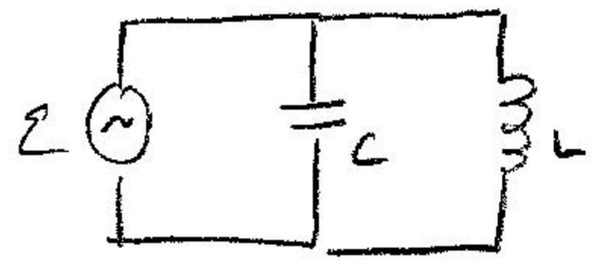
29-58 GIVEN:



$C = 25\mu F$

$L = 4H$

$\mathcal{E} = 100V \cos(2\pi f t)$

FIND: (a) I_C, I_L

(b) ω_0 AT RESONANCE

(c) I_C, I_L AT RESONANCE

(d) $\omega > \omega_0$ PHASOR DIAGRAM

(a) $\mathcal{E} - \frac{Q}{C} = 0 \Rightarrow Q = C\mathcal{E} = C\mathcal{E}_{max}\cos(2\pi f t)$

$$I_C = \frac{dQ}{dt} = -C\mathcal{E}_{max}\, 2\pi f \sin(2\pi f t)$$

$$I_C = -(25\mu F)(100V)(2\pi)\, f \sin(2\pi f t)$$

$$= -(1.57\times10^{-2}\, C)(f) \sin(2\pi f t)$$

$\mathcal{E} - L\frac{dI_L}{dt} = 0 \Rightarrow \frac{dI_L}{dt} = \frac{\mathcal{E}}{L} = \frac{\mathcal{E}_{max}\cos(2\pi f t)}{L}$

$$I_L = \frac{\mathcal{E}_{max}\sin(2\pi f t)}{2\pi f\, L}$$

$$I_L = \frac{100V}{2\pi(4H)f}\sin(2\pi f t)$$

$$= \frac{3.98}{f}\left(\frac{A}{s}\right)\sin(2\pi f t)$$

(b) $X_C = X_L$

$\frac{1}{\omega C} = \omega L$

$$\omega = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{4H\ 25\mu F}}$$

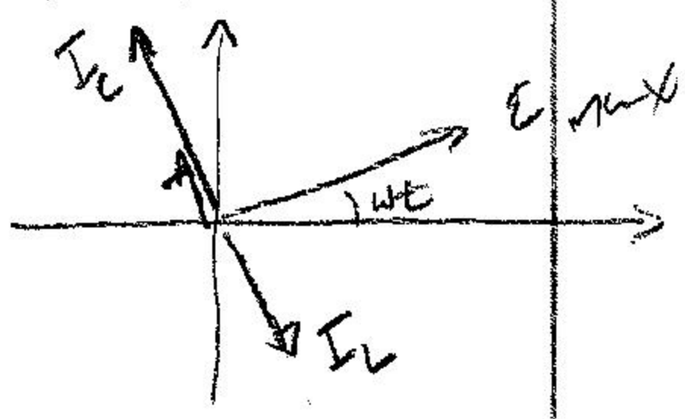
$$= 100\ rad/s = 2\pi f$$

$$f = \frac{100\ RAD/s}{2\pi} = 15.9\ Hz$$

(c) $I_C = -(1.57\times10^{-2}C)(15.9Hz)\sin(100t) = -.250A \sin(100t)$

$$I_L = \frac{3.98\ A}{15.9\ s}\sin(100t)$$

$$= +.250A \sin(100t)$$

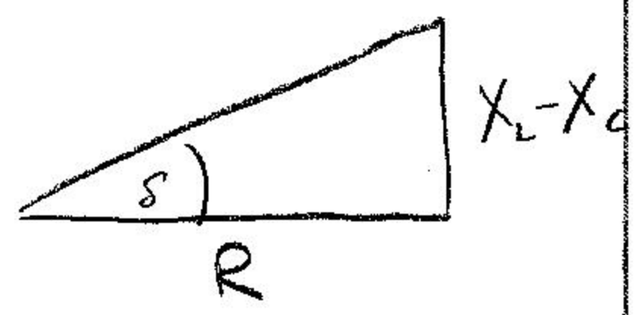


29-65 GIVEN: SERIES RLC CKT

$\mathcal{E}_{max} = 100V$

$L = 10\,mH$
$C = 2.0\,\mu F$
$R = 5.0\,\Omega$

FIND: (a) Q
(b) $\Delta\omega$
(c) $\cos\delta$



$$\omega_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{(10\,mH)(2.0\,\mu F)}} = 7070\,\frac{RAD}{s}$$

$$Q = \frac{\omega_0 L}{R} = \frac{(7070\,\frac{rad}{s})(10\times10^{-3}\,H)}{5.0\,\Omega}$$

$$= \boxed{14.1}$$

$$Q = \frac{\omega_0}{\Delta\omega} \Rightarrow \Delta\omega = \frac{\omega_0}{Q} = \frac{7070\,\frac{RAD}{s}}{14.1}$$

$$= \boxed{500\,RAD/s} \quad (80\,Hz)$$

$$X_L = \omega L = (8000\,\tfrac{rad}{s})(10\,mH) = 80\,\Omega$$

$$X_C = \frac{1}{\omega C} = \frac{1}{(8000\,\frac{rad}{s})(2\times10^{-6}\,F)} = 62.5\,\Omega$$

$$\cos\delta = \frac{R}{\sqrt{R^2 + (X_L - X_C)^2}} = \frac{5\Omega}{\sqrt{(5\Omega)^2 + (80\Omega - 62.5\Omega)^2}}$$

$$= \boxed{.274}$$

29-72 GIVEN: DRIVEN SERIES RLC CKT

$\mathcal{E}_{max} = 200V$

$R = 60.0\,\Omega$

$C = 8.00\,\mu F$

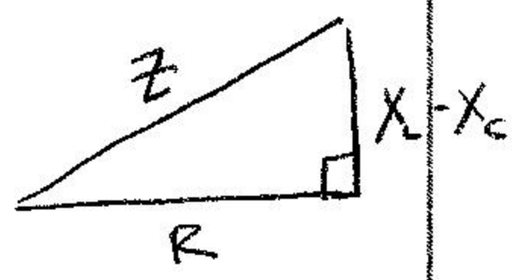
$L = 8.00\,mH \rightarrow 40\,mH$

$\omega = 2500\,rad/s$

$V_C < 150V$

FIND: I_{peak}, L

$$I = \frac{\mathcal{E}_{max}}{Z} \cos(\omega t - \delta)$$



$$X_L = \omega L = \left(2500\,\tfrac{rad}{s}\right)(L) = 20\,\Omega \rightarrow 100\,\Omega$$

$$X_C = \frac{1}{\omega C} = \frac{1}{\left(2500\,\tfrac{rad}{s}\right)(8\,\mu F)} = 50\,\Omega$$

$$I_{peak} = \frac{\mathcal{E}_{max}}{\sqrt{R^2 + (X_L - X_C)^2}}$$

$$= \frac{200\,V}{\sqrt{3600\,\Omega^2 + (2500\,L - 50\,\Omega)^2}}$$

$$V_C = I_{peak} X_C = \frac{(200\,V)(50\,\Omega)}{\sqrt{3600\,\Omega^2 + (2500\,L - 50\,\Omega)^2}} = 150V$$

TI-92 $L = 31.6\,mH$ $L = 8.37\,mH$

$8\,mH \rightarrow 8.37\,mH$

$31.6\,mH \rightarrow 40.0\,mH$