# Tutorial 5

**Q.1.** Use the Bode approach to sketch the magnitude of each of the following

**(a)**

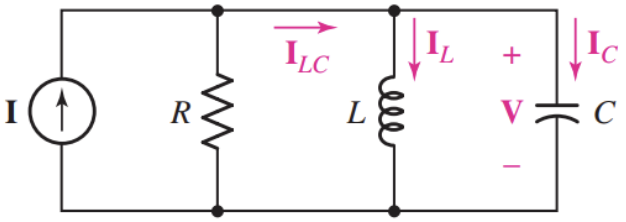
$$\frac{4}{\mathbf{s}^3 + 7\mathbf{s}^2 + 12\mathbf{s}}$$

**(b)**

$$\frac{\mathbf{s} + 300}{\mathbf{s}(5\mathbf{s} + 8)}$$

**Q.2.**

For the circuit shown in Fig. 16.1, let $R = 1$ kΩ, $C = 22$ mF, and $L = 12$ mH. (*a*) Calculate $\alpha$, $\omega_0$, $\zeta$, $f_0$, and $\omega_d$ for the circuit. (*b*) If $\mathbf{I} = 1\angle 0°$ A, plot $\mathbf{V}$, $\mathbf{I}_{LC}$, $\mathbf{I}_L$, and $\mathbf{I}_C$ as a function of frequency, and verify that $\mathbf{I}$ and $\mathbf{V}$ are in phase at $\omega_0$. (*c*) What is the relationship of $\mathbf{I}_L$ to $\mathbf{I}_C$ at $\omega_0$?




**Q.3.**

A parallel *RLC* network is constructed with a 5 mH inductor, and the remaining component values are chosen such that $Q_0 = 6.5$ and $\omega_0 = 1000$ rad/s. Determine the approximate value of the input impedance magnitude for operation at (*a*) 500 rad/s; (*b*) 750 rad/s; (*c*) 900 rad/s; (*d*) 1100 rad/s. (*e*) Plot your estimates along with the exact result using a linear frequency (rad/s) axis.

**Q.4.**

With regard to the series *RLC* circuit described in Exercise 15, adjust the resistor value such that $Q_0$ is reduced to 5, and (*a*) estimate the angle of the impedance at 90 krad/s, 100 krad/s, and 110 krad/s. (*b*) Determine the percent error in the estimated values, compared to the exact expression.

**Q.5.**

For the network represented in Fig. 16.55, determine the resonant frequency and the corresponding value of $|\mathbf{Z}_{in}|$.

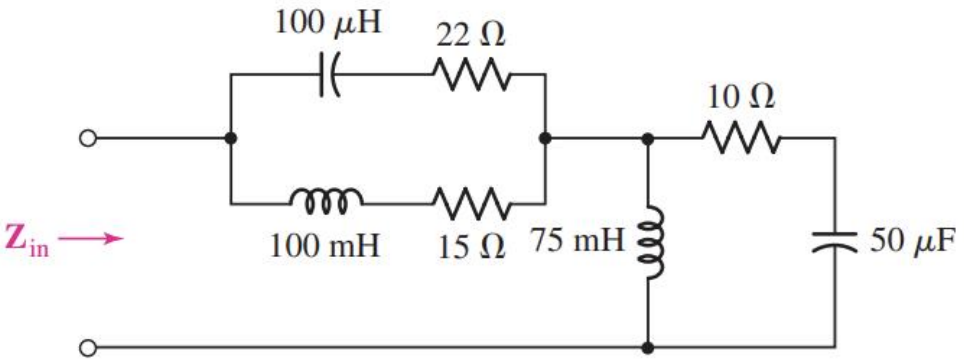



**FIGURE 16.55**