

Problem 9.36 For the circuit shown in Fig. P9.36:

- (a) Obtain an expression for $\mathbf{H}(\omega) = \mathbf{V}_o/\mathbf{V}_i$ in standard form.
- (b) Generate spectral plots for the magnitude and phase of $\mathbf{H}(\omega)$, given that $R = 50 \Omega$ and $L = 2 \text{ mH}$.

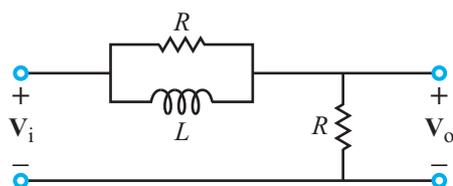


Figure P9.36: Circuit for Problem 9.36.

Solution:

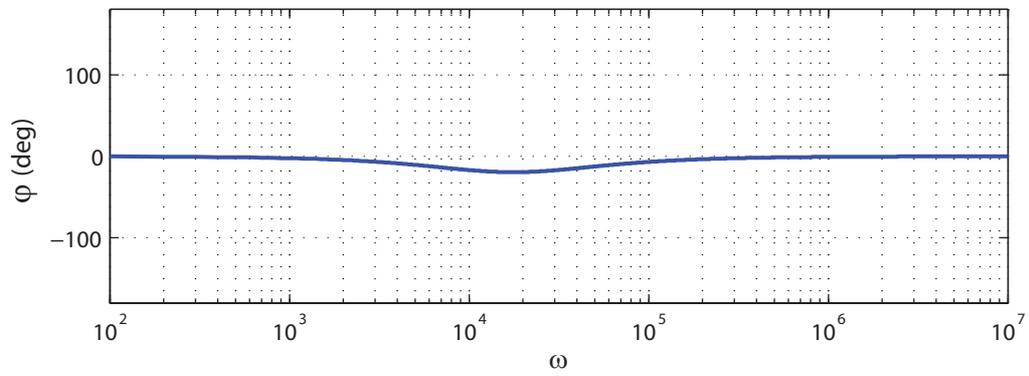
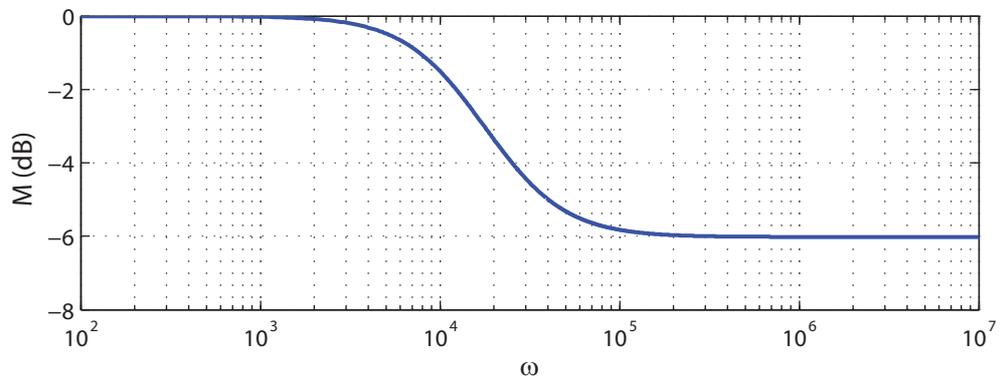
(a) Voltage division yields

$$\begin{aligned}\mathbf{H}(\omega) &= \frac{\mathbf{V}_o}{\mathbf{V}_i} = \frac{R}{R + (R \parallel j\omega L)} \\ &= \frac{1 + j\omega L/R}{1 + j2\omega L/R} \\ &= \frac{1 + j\omega/\omega_{c1}}{1 + j\omega/\omega_{c2}},\end{aligned}$$

with

$$\begin{aligned}\omega_{c1} &= \frac{R}{L} = 2.5 \times 10^4 \text{ rad/s}, \\ \omega_{c2} &= \frac{\omega_{c1}}{2} = 1.25 \times 10^4 \text{ rad/s}.\end{aligned}$$

(b) Spectral plots of M [dB] and $\phi(\omega)$ are shown in Figs. P9.36(a) and (b).



Figures P9.36(a) and (b)