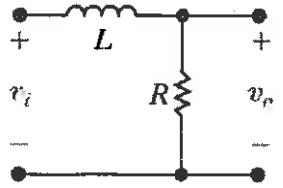
SOLUTION

ECE222
Quiz 7

To get full credit, show all your work.

a) Find the transfer function: $H(s) = \frac{V_o}{V_i}$ for the following circuit.



VOLTAGE DIVIDER RULE ⇒

$$H(s) = \frac{R}{sL + R} \quad \text{OR} \quad H(s) = \frac{1}{1 + \frac{s}{R/L}}$$

b) State the locations of all the poles and zeros. Including any non-finite locations.

POLE AT $s = -\frac{R}{L}$

ZERO AT INFINITY, $s = \infty$

c) Assuming values of $L = 10mH$ and $R = 10\Omega$ and an input signal $v_i(t) = 10\cos(1000t + 25°)$ determine the steady state output $v_o(t)$.

$$H(j\omega) = \frac{1}{1 + j\frac{\omega}{R/L}} \qquad \frac{R}{L} = \frac{10}{10 \times 10^{-3}} = 1000$$

$$\omega = 1000$$

$$\Rightarrow \quad H(j\omega)\Big|_{\omega=1000} = \frac{1}{1+j\frac{1000}{1000}} = \frac{1}{1+j}$$

$$\left|H(j\omega)\right|_{\omega=1000} = \left|\frac{1}{1+j}\frac{1-j}{1-j}\right| = \left|\frac{1-j}{1+1}\right| = \left|\frac{1}{2} - \frac{1}{2}j\right| = \sqrt{\left(\frac{1}{2}\right)^2 + \left(-\frac{1}{2}\right)^2} = \frac{1}{\sqrt{2}}$$

$$= 0.707$$

$$\angle H(j\omega)\Big|_{\omega=1000} = \arctan\left(\frac{-\frac{1}{2}}{\frac{1}{2}}\right) = \arctan(-1) = -45°$$

$$\Rightarrow \quad v_o(t) = 10 \times 0.707 \cos\left(1000t + 25° - 45°\right)$$

$$v_o(t) = 7.07 \cos\left(1000t - 20°\right)$$