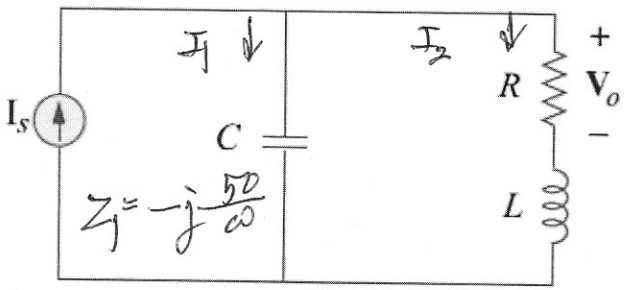
Solution

# EE101 Quiz 9, March 12, 2018

2nd Qz 9 on Friday March 16 in the beginning of the class.

Name_____ Student ID_____

For a second-order circuit below with C= 0.02F, L=5 mH and R= 10 Ω,




(a) (6 points) Find the transfer function H(jω) = $V_o(j\omega)/I_s(j\omega)$, which is also called a transfer impedance. (Hint: Express $V_o(j\omega)$ in terms of $I_s(j\omega)$ first, then find H(jω).)

$$H(j\omega) = \frac{R\,I_2}{I_s} = \frac{R\,Z_1}{Z_1+Z_2} = \frac{10\left(-j\frac{50}{\omega}\right)}{-j\frac{50}{\omega}+10+j(5\times10^{-3})\omega} = \frac{10(-j50)}{-j50+10\omega+j(5\times10^{-3})\omega^2}$$

$$= \frac{10(-j50)}{10\omega+j(5\times10^{-3}\omega^2-50)}$$

$$\omega_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{5\times10^{-3}\times2\times10^{-2}}} = \frac{1}{\sqrt{1\times10^{-4}}} = 10^2$$

(b)(4 points) Find the magnitude of the transfer function H(jω) at ω=2$\omega_o$, where $\omega_o^2$= 1/(LC)

$$\omega = 2\omega_0 = 200$$

$$|H(j\omega)|_{\omega=200} = \left|\frac{-j50\times10}{10(200)+j(5\times10^{-3}\times4\times10^4-50)}\right|$$

$$= \left|\frac{-j50\times10}{2000+j150}\right| = \frac{50\times10}{100\sqrt{(20)^2+(1.5)^2}}$$

$$= \frac{5}{20} = 0.25$$