Signals and Systems ECE 202
Assignment 11

Document and submit your analytic results. Also generate and publish a MATLAB document, where appropriate, for the following exercises. Submit your MATLAB html folder and original MATLAB code (m files).

1. A system has an impulse response

$$h_1(t) = 3e^{-10t}u(t)$$

and another has an impulse response

$$h_2(t) = \delta(t) - 3e^{-10t}u(t)$$

Find the magnitude and phase of the transfer function of these two functions if the systems are in series or parallel. Use MATLAB to plot your answer (if non trivial).

2. Determine whether or not the following systems with these transfer functions are causal.

   (a) $H(f) = \text{sinc}(f)$
   (b) $H(f) = \text{sinc}(f)e^{-j\pi f}$
   (c) $H(j\omega) = \text{rect}(\omega)$
   (d) $H(j\omega) = \text{rect}(\omega)e^{-j\omega}$
   (e) $H(f) = A$
   (f) $F(f) = Ae^{j2\pi f}$

3. Classify each of these transfer functions as having a lowpass, highpass, bandpass, or bandstop frequency response.

   (a) $H(f) = \frac{1}{1+jf}$
   (b) $H(f) = \frac{jf}{1+jf}$
   (c) $H(j\omega) = \frac{j10\omega}{100-\omega^2+j10\omega}$
   (d) $H(F) = \frac{\sin(3\pi F)}{\sin(\pi F)}$
   (e) $H(j\Omega) = j[\sin(\Omega) + \sin(2\Omega)]$

4. Use MATLAB to plot the magnitude frequency responses, both on a linear-magnitude and on a log-magnitude scale of the systems with these transfer functions over the frequency range specified.

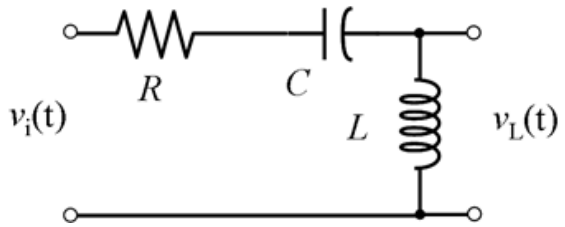
   (a) $H(f) = \frac{20}{20-4\pi^2 f^2+j42\pi f}$ over $-100 \le f \le 100$

   (b) $H(j\omega) = \frac{2\times10^5}{(100+j\omega)(1700-\omega^2+j20\omega)}$ over $-500 \le \omega \le 500$

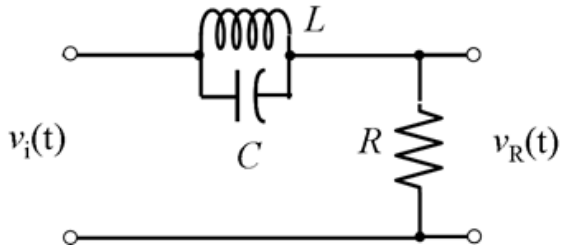
5. Find frequency response of each of the following circuits (use MATLAB to plot) and the parameters α and ω_0^2 of the corresponding second-order equation:

$$v''(t) + 2\alpha v'(t) + \omega_0^2 v(t) = \omega_0^2 x(t)$$

   (a) Let $R = 10\Omega$, $C = 1\mu$F, and $L = 1$ mH in the circuit below



   (b) Let $R = 1$ kΩ, $C = 1\mu$F, and $L = 1$ mH in the circuit below



   (c) Let $R = 100\ \Omega$, $C = 1\ \mu$F, and $L = 1$ mH in the circuit below