METU/EEED

EE 202/YPS VII

Spring 2013

1) Given the system function $H(s)=\dfrac{30(s+1)}{s^2+8s+15}$.

(a) Plot the pole/zero diagram.

(b) Sketch the magnitude and phase characteristics.

2) Given the transfer admittance $Y_T(s)=\dfrac{s^2+9}{s^2+10s+16}$ ℧.

(a) Plot the pole/zero diagram.

(b) Sketch the magnitude and phase characteristics.

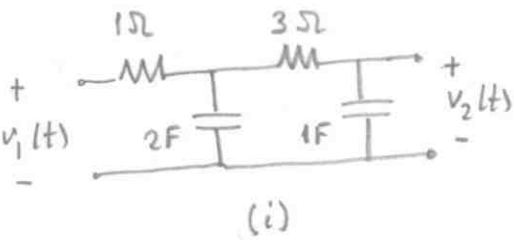
(c) Find the steady-state response to the excitation

$$24+6\cos(3t+15^\circ)-5\sin(4t-72^\circ)\ \text{V}.$$

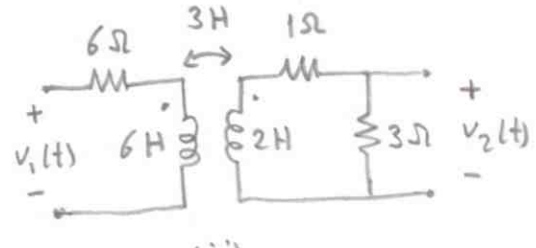
3) (a) Obtain the transfer voltage ratio.

(b) Plot the pole/zero diagram.

(c) Sketch the magnitude and phase characteristics.

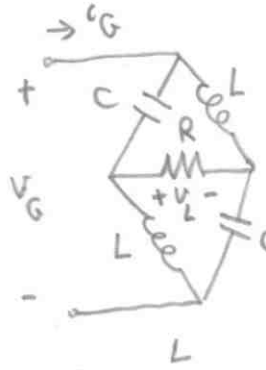


(i)



(ii)

4)



$RC=\dfrac{L}{R}$

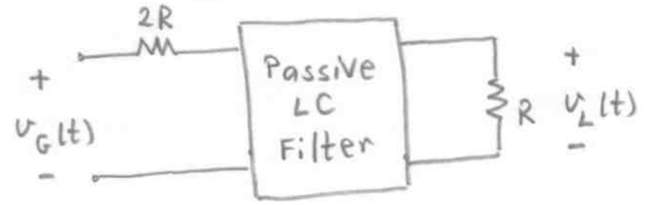
(a) Find the natural frequencies.

(b) Obtain the input admittance $Y_{in}(s)=\dfrac{I_G(s)}{V_G(s)}$.

(c) Obtain the transfer voltage ratio $H(s)=\dfrac{V_L(s)}{V_G(s)}$.

Plot the pole/zero diagram.

Sketch the magnitude and phase characteristics.

5) 

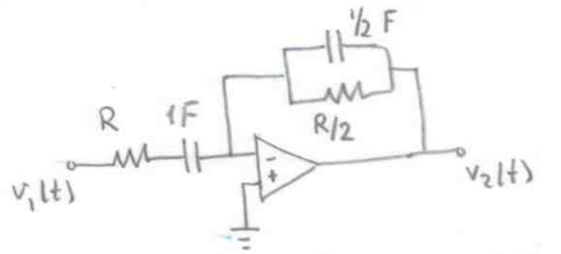
$H(s) = \dfrac{V_L(s)}{V_G(s)}$ is a second order bandpass transfer function.

(a) Let $R = 1\ \Omega$. Provide two filter structures and determine the element values so that the peak frequency is 1 rad/sec and the half-power bandwidth is 0.5 rad/sec.

(b) Sketch the magnitude and phase characteristics.

(c) Scale the circuits so that the peak frequency is 4 KHz and $R = 2\ K\Omega$.

(d) Compare the two structures. Comment.

6) 

(a) Let $R = 2\ \Omega$. Obtain the transfer function $H(s) = V_2(s)/V_1(s)$. Plot the pole/zero diagram. Sketch the magnitude and phase characteristics.

(b) Scale the circuit so that $R = 10\ K\Omega$ and the magnitude response function peaks at 4 Krad/sec.

7) The magnitude response function of the nth order $(n = 1, 2, 3, \ldots)$ lowpass Butterworth filter of cutoff frequecy w_0 is

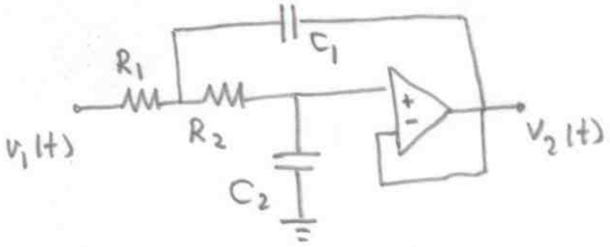
$$|H(jw)| = 1 \Big/ \sqrt{1 + (w/w_0)^{2n}}$$

(a) The transfer function of a second order lowpass Butterworth filter is

$$H(s) = \frac{w_0^2}{s^2 + 2\alpha s + w_0^2}$$

Find the $Q = \dfrac{w_0}{2\alpha}$ of this filter.

(b)

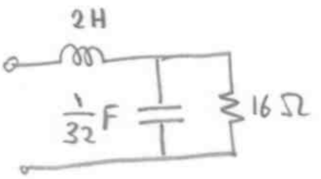


(i) Obtain the transfer function $H(s) = V_2(s)/V_1(s)$.

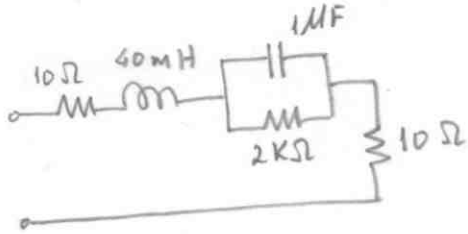
(ii) Design the circuit so that $H(s)$ is the second order lowpass Butterworth filter transfer function with $\omega_o = 1$ rad/sec.

(iii) Scale the circuit so that $R_1 = 10\ K\Omega$ and $\omega_o = 2\pi \cdot 10^3$ rad/sec.

8)



(i)



(ii)

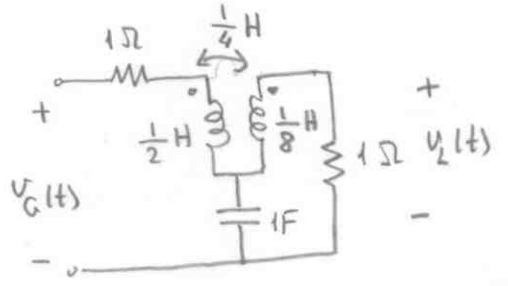
(a) Obtain the input impedance. Plot the pole/zero diagram.

(b) Find the resonant frequency ω_o.

(c) Sketch the approximate magnitude and phase characteristics.

(d) For the input voltage $V_m \cos(\omega_o t + \theta_s)$, P is the average power input and E is the sum of the average stored energies in the dynamic elements. Compute $\omega_o E/P$. Discuss.

9)



(a) Obtain the transfer function $H(s) = \frac{V_2(s)}{V_G(s)}$.

(b) Plot the pole/zero diagram.

(c) Sketch the magnitude and phase characteristics.

(d) Obtain the magnitude and phase Bode plots.

10) Plot the pole/zero diagram. Obtain the magnitude and phase Bode plots.

(a) $H(s) = \frac{100s(s+200)}{(s+20)(s+1000)}$, (b) $H(s) = \frac{40s^2}{(s+20)(s^2+s+4)}$, (c) $H(s) = \frac{s^2+100s+10^4}{(s+10)^2}$