

Tutorial 4

Fri 14/08/2015 (5PM – 6:30PM)

EE101

1.

- a) For the circuit shown in fig. 1. What is the voltage transfer function $H(j\omega) = V_2/V_1$?

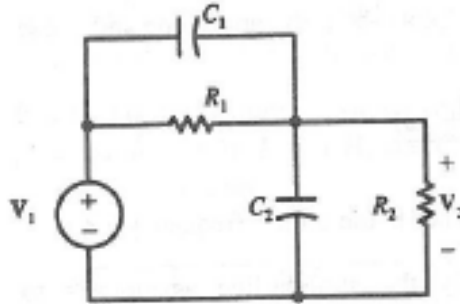


Fig.1

- b) Suppose that $R_2=R_1=R$ and $C_2=C_1=C$. Sketch the amplitude response and phase response of V_2/V_1 ? What is the half power frequency?
2. Using only straight line asymptotes, Sketch the bode plot for both the amplitude and phase responses for

$$H(j\omega) = \frac{j\omega}{a + j\omega}$$

Where $a>0$. What is the corner frequency? What type of filter is this?

3. The transfer function $H(j\omega) = \frac{1}{1+j\omega 11+(j\omega)^2 10}$ can be expressed as a product of two transfer functions $H_1(j\omega)$ and $H_2(j\omega)$ where $H_1(j\omega) = \frac{1}{1+j\omega}$ and $H_2(j\omega) = \frac{1}{1+j\omega 10}$. Sketch the bode plot for $H(j\omega)$ by adding the bode plots for $H_1(j\omega)$ and $H_2(j\omega)$.

(Note: Students are encouraged to plot the transfer function using MATLAB/SCILAB to see the errors w.r.t. actual Bode plot. Also vary the pole values and check for the variation in error)

4. For the circuit shown in fig. 2. Find $H(j\omega) = I_o(j\omega)/I_s(j\omega)$.

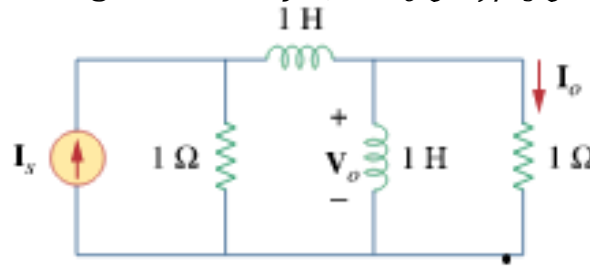


Fig.2

5. Suppose that a filter has gain

$$|H(j\omega)| = \frac{16\omega}{(\omega^2 + 4)}$$

- For what value of ω is the gain $|H(j\omega)|$ maximum?
 - What is the maximum value M of the gain $|H(j\omega)|$?
 - What are the half-power frequencies?
 - What is the bandwidth of the filter?
6. Sketch the asymptotic bode plot for the amplitude response of the low pass filter

$$\frac{V_2}{V_1} = \frac{1}{(1 + j\omega RC)}$$

- What is $|H(j\omega)|$ in dB at $0.5\omega_c$ and $2\omega_c$? What is the error w.r.t. asymptotic bode plot.
(Note: A change in frequency by a factor of 2 is referred as an octave)
- What is $|H(j\omega)|$ in dB at $0.1\omega_c$ and $10\omega_c$? What is the error w.r.t. asymptotic bode plot.
(Note: A change in frequency by a factor of 10 is referred as a decade)