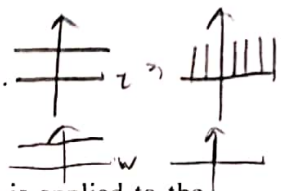


Final Exam

E927500
Circuit Analysis
June 25, 2015

A. (4x12=48 points) Answer each of the following statements.

1. Comparison between "transfer function" and "frequency response".
2. Comparison between "impulse response" and "transfer function".
3. Comparison between "convolution" and "multiplication".
4. Comparing convolutions by "mathematics" and "physics".
5. Comparison between "causal input" and "causal system".
6. Comparison between "Fourier" and "Laplace" transforms in transient response.
7. Comparison between "Fourier" and "Laplace" transforms in time function.
8. Comparison between "Fourier" and "Laplace" transforms in s plane.
9. Comparison between "zero" and "pole" in frequency response.
10. Comparison between the Fourier transforms of " $\sin \omega_0 t$ " and " $\cos \omega_0 t$ ".
11. Comparison between " $\delta(\omega)$ " and "1" in frequency-domain by Fourier transform.
12. Comparison between the "RC" and "LCR" circuits.



B. (4+6+4+8+4+3+3=32 points) $v_i(t) = 5 \sin(\omega t) u(t)$ V voltage with $\omega = 100$ rad/s is applied to the op amp circuit and +2 V is across the capacitor at $t = 0$ in Fig. 1. Find the (a) impulse response, (b) transfer function, and (c) frequency response between the output voltage $v_o(t)$ and the input voltage $v_i(t)$. Find the (d) natural response, and the forced response of $v_o(t)$. Also, indicate the (e) transient response and the steady-state response in $v_o(t)$. Compute the (f) closed-loop gain and phase shift. Now, if $\omega = 10$ rad/s, find the (g) closed-loop gain and phase shift.

~~$H(s) = \frac{1}{s+1}$~~ $H(s) = \frac{1}{s+1}$

C. (10+5=15 points): Find the (a) current $i_o(t)$ in the circuit in Fig. 2, give that $i_s(t) = 5 \cos 4t$ A and indicate the (b) gain and phase change.

D. (5+10=15 points) (a) Explain the Bode plots. Assume the frequency response of the system is

$$H(\omega) = \frac{10 - 5\omega^2}{(5 + j\omega)(10 + j\omega)(100 + j\omega)}$$

(b) Please plot the Bode diagram of the system using Matlab.

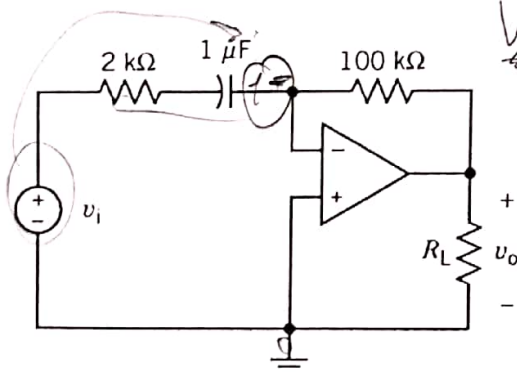


Fig. 1

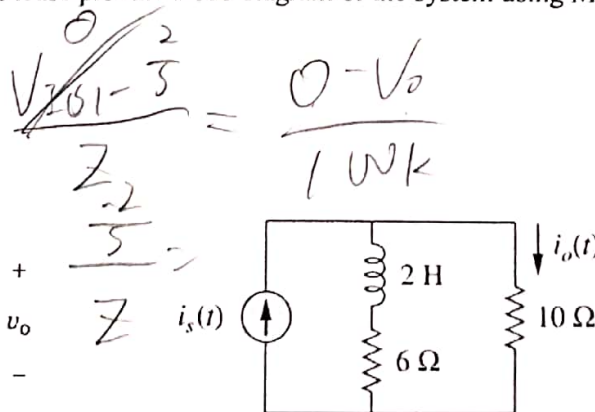


Fig. 2

Have a Nice Summer!