EC 2102 Network and System - HW 8

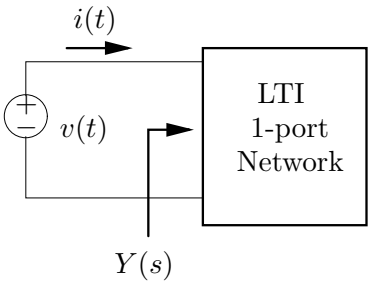
October 29, 2012

1. The output of an LTI system (with zero initial conditions) to the input $u(t)$ is $[4e^{-t} - 3e^{-2t}]u(t)$. Find (a) the impulse response, (b) the system function, (c) the response to the input $e^{-4t}u(t)$, and (d) the steady state response to the input $\cos 2t$.

2. Sketch the pole-zero plot corresponding to the following system functions: (a) $\dfrac{s-2}{s^2+8s+15}$, (b) $\dfrac{s+1}{(s+2)^2(s+3)}$, (c) $\dfrac{2s^2+s+1}{s(s+2)}$, and (d) $\dfrac{2s+1}{(s+2)(s^2+1)^2}$. Which of the above system functions correspond to BIBO stable systems?

3. A system has a transfer function with poles $s = -1 \pm j$ and a zero at $s = -a$. The response of this system to a step input has a term of the form $K_2 e^{-t}\sin(t+\phi)$. Express K_2 in terms of a. Plot the value of K_2 as a function of a for values of a between 0 and 5.

4. The admittance function $Y(s)$ has poles at $s = -1 \pm j1$ and two zeros.

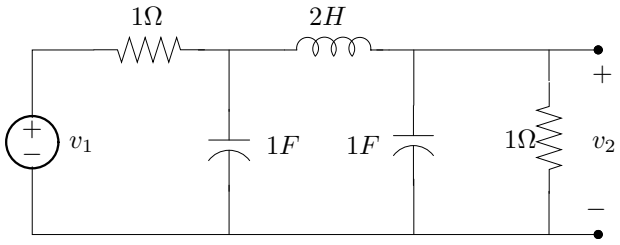


The steady state current to a 6V dc input and a sinusoidal input $\sin t$ is given below.

$v(t)$	Steady state component of $i(t)$
6V dc	0 A
$\sin t$ V	$0.6\sin t + 0.8\cos t$

Determine the steady state current for the input voltage $\sin 2t$ V.

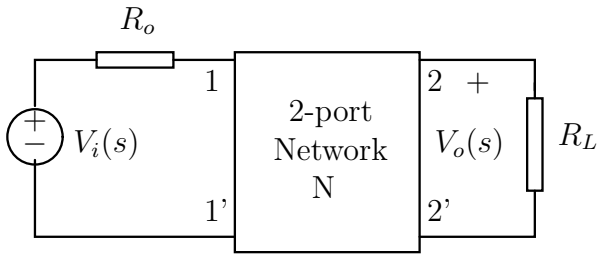
5. Consider the network shown below.



   (a) Find the transfer function $H(s) = V_2(s)/V_1(s)$.

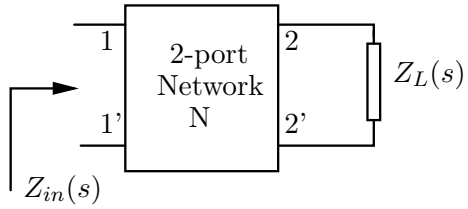
   (b) Sketch the magnitude of the frequency response function $H(s)|_{s=j\omega}$ as a function of ω.

6. Find $V_o(s)/V_i(s)$ of the terminated 2-port network N in terms of R_o, R_L, and the $z-$parameters of N.



7. Let the open circuit impedance matrix of network N be

$$\begin{bmatrix} 0 & -r \\ r & 0 \end{bmatrix}.$$



Find $Z_{in}(s)$ in terms of r and $Z_L(s)$. If $Z_L(s)$ is $1/Cs$, show that the network behaves like an inductor at the input terminals.

— END —