EC2102 Networks and Systems – HW 9

November 12, 2012

1. Consider the system with the state equation

$$\begin{bmatrix} \dot{x_1} \\ \dot{x_2} \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$$

and the output equation

$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}.$$

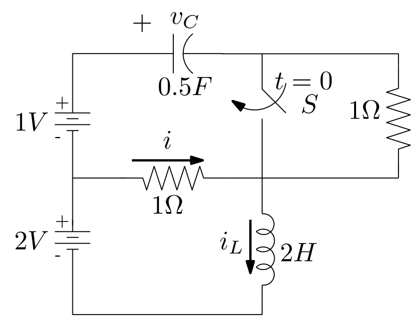
Find $H_{32}(s)$.

2. Find the state vector $\mathbf{x}$ for the system whose state equation is given by $\dot{\mathbf{x}} = \mathbf{A}\mathbf{x} + \mathbf{B}\mathbf{u}$, where

$$\mathbf{A} = \begin{bmatrix} -12 & 2/3 \\ -36 & -1 \end{bmatrix}, \quad \mathbf{B} = \begin{bmatrix} 1/3 \\ 1 \end{bmatrix},$$

$\mathbf{u} = [u(t)]$ (i.e., unit step input), and the initial conditions are $x_1(0) = 2$ and $x_2(0) = 1$.

3. Switch S is closed at $t = 0$ after steady state is reached in the network shown. Choosing v_C and i_L as state variables, and i as the output:
   (a) Form the state and output equations.
   (b) Find the zero-state, zero-input, and total responses.



4. Following problems are from the text book and deal with the Bode plot
(a) 4.9-1, (b) 4.9-2 and (c) 4.9-3.