國立交通大學電機資訊學士班 93(下) 訊號與系統 期末考

1. For the following signal

10% $x(t) = e^{-2t}\left[u(t) - u(t-1)\right]$

find the Laplace transform $X(s)$ and sketch the pole/zero plot.

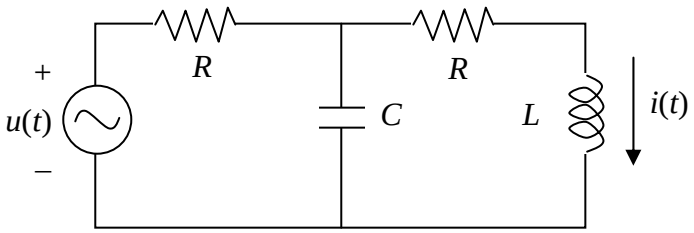
2. Given the following Laplace transform

12% $X(s) = \dfrac{5}{s^3 + s^2 - 2}$

(a) find all the possible $x(t)$ corresponding to different *ROC*s.

(b) determine the causality and stability of $x(t)$ found in (a).

3. Consider the following circuit with R=1Ω, C=1F, L=1H:



10%

(a) Find the transfer function $H(s)$, which is equal to $I(s)/U(s)$ with $I(s)$ and $U(s)$ being the Laplace transform of $i(t)$ and $u(t)$, respectively.

3%

(b) As t→∞, determine $i(t)$ if $u(t)=sin(2t)$ (volt).

3%

(c) As t→∞, determine $i(t)$ if $u(t)$=1 (volt).

6% (d) The circuit can be expressed as $\dot{\boldsymbol{x}} = \boldsymbol{A}\boldsymbol{x} + \boldsymbol{b}\,u(t)$, where $\boldsymbol{x} = \begin{bmatrix} x_1 & x_2 \end{bmatrix}^T$, x_1=$i(t)$, and x_2=$v(t)$. Please find $\boldsymbol{A}$ and $\boldsymbol{b}$.

12% (e) Calculate e^{At}.

4. Design the third order Butterworth filter $H(s)$ with half-power frequency set at ω=2 *rad*/*sec*.

16% (a) What is the transfer function $H(s)$.

3% (b) Express the filter in ODE with input $x(t)$ and output $y(t)$.

5. Use OPAmps to implement the following system:

15% $H(s) = \dfrac{s^2 + 1}{s^3 + 3s^2 + 5s + 3}$

6. Determine the following system function $H(s)$:

10%