Homework No. 8

Due 15:00 , June 12, 2008

1. Determine the **bilateral** Laplace transform or the inverse Laplace transform for the following signals:

   (1) $x(t)=\frac{d^2}{dt^2}\left(e^{-3(t-2)}u(t-2)\right)$. (10%)

   (2) $X(s)=s^{-1}\frac{d}{ds}\left(\frac{e^{-3s}}{s}\right)$ with ROC $\text{Re}\{s\}>0$. (10%)

2. Use the method of partial fractions to determine the time signals corresponding to the following **bilateral** Laplace transform:

$$X(s)=\frac{-s-4}{s^2+3s+2}$$

   (1) With ROC $\text{Re}\{s\}<-2$ (5%)

   (2) With ROC $\text{Re}\{s\}>-1$ (5%)

   (3) With ROC $-2<\text{Re}\{s\}<-1$ (5%)

3. A system has the indicated transfer function $H(s)$. Determine the impulse response, assuming (a) that the system is causal and (b) that the system is stable. (10%)

$$H(s)=\frac{2s^2+2s-2}{s^2-1}$$

4. Determine (a) whether the system described by the following transfer function is both stable and causal and (b) whether a stable and causal inverse system exists:

$$H(s)=\frac{s+5}{2s^2+4s+4}$$

   You need to justify your answers. (15%)

5. Determine the **unilateral** Laplace transform of the following signals, <u>using the defining equation</u>:

   (1) $x(t)=u(t)-u(t-6)$ (10%)

   (2) $x(t)=\begin{cases}\sin(\pi t), & 0<t<1\\ 0, & \text{otherwise}\end{cases}$ (10%)

6. Given the transform pair $x(t) \xleftrightarrow{\mathcal{L}} \dfrac{2s}{s^2+2}$, where $x(t)=0$ for $t<0$, determine the Laplace transform of the following time signals: (20%)

(1) $x(t-1)$

(2) $x(t) * \dfrac{d}{dt}x(t)$

(3) $e^{-3t}x(t)$

(4) $\int_0^t x(3\tau)\,d\tau$