Homework No. 7

Due 11:10 am, June 16, 2005

1. (Textbook 6.27(a) and (d)) Determine the **bilateral** Laplace transform and ROC for the following signals:

   (1) $x(t) = e^{-t}u(t+2)$ (7%) (2) $x(t) = \sin(t)u(t)$ (8%)

2. (Textbook 6.42(a) and (d)) Use the tables of transforms and properties to determine the time signals that correspond to the following **bilateral** Laplace transforms:

   (1) $X(s) = e^{5s}\dfrac{1}{s+1}$ with ROC $\mathrm{Re}\{s\} < -2$ (7%)

   (2) $X(s) = s^{-2}\dfrac{d}{ds}\left(\dfrac{e^{-3s}}{s}\right)$ with ROC $\mathrm{Re}\{s\} > 0$ (8%)

3. (Textbook 6.43(a)) 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 $\mathrm{Re}\{s\} < -2$ (5%)

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

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

4. (Textbook 6.45(a) and 6.46(b))

   (1) 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%)

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

   (2) A stable system has the indicated input $x(t)$ and output $y(t)$. Use Laplace transforms to determine the transfer function and impulse response of the system. (10%)

$$x(t) = e^{-2t}u(t),\ y(t) = -2e^{-t}u(t) + 2e^{-3t}u(t)$$

5. (Textbook 6.28(f) and (g)) Determine the **unilateral** Laplace transform of the following signals, <u>using the defining equation</u>:

   (1) $x(t) = u(t) - u(t-2)$ (7%)

(2) $x(t)=\begin{cases}\sin(\pi t), & 0<t<1\\ 0, & \text{otherwise}\end{cases}$ (8%)

6. (Textbook 6.32(b), (c), (d), and (f)) Given the transform pair $x(t)\overset{\mathcal{L}}{\longleftrightarrow}\frac{2s}{s^2+2}$, where $x(t)=0$ for $t<0$, determine the Laplace transform of the following time signals: (20%)

(1) $x(t-2)$

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

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

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