Signals and Systems 3 October 2012
Fall 2012 Quiz: Wednesday 10 October 2012

Homework Assignment #7

1. Find the inverse z transform of each of the following functions.

(a) $F(z) = 2 + 3z^{-1} + 6z^{-3} + 4z^{-7}$

(b) $F(z) = \dfrac{z+1}{(z-1)(z-e^{-2T})}$, $T = \dfrac{1}{2}$

(c) $F(z) = \dfrac{z+1}{z^6(z-1)}$

(d) $F(z) = \dfrac{z+1}{z^2-3z+2}$

(e) $F(z) = \dfrac{z^2+2z+1}{(z+0.5)^3(z-1)}$

(f) $F(z) = \dfrac{z+1}{z^2-2z+2}$

2. For each of the z-domain functions given in Problem 1, determine whether the Final Value Theorem is applicable. If so, use it to compute the limit of $f(k)$ as $k \to +\infty$.

3. Use the z transform to find the zero-state response of an LTI system to a unit step sequence if the system impulse response is

(a) $h(k) = \begin{cases} 1, & k \geq 0 \\ 0, & k < 0 \end{cases}$,

(b) $h(k) = \begin{cases} 1, & k = 0 \\ 2, & k = 1 \\ 3, & k = 2 \\ 0 & \text{otherwise} \end{cases}$,

(c) $h(k) = \begin{cases} (0.9)^k, & k \geq 0 \\ 0, & k < 0 \end{cases}$. [Ans: $y(k) = 10 - 9(0.9)^k$, $k = 0,1,2,\cdots$.]

4. Use z transforms to find the zero-state response $y_{ZS}(k)$ for each system ($h(k)$, $H(E)$, or $H(z)$) with the given input ($x(k)$ or $X(z)$). Note that $u_s(k)$ denotes the unit step sequence, and $\delta(k)$ denotes the unit sample sequence.

(a) $h(k) = (1/2)^k u_s(k) + \delta(k)$, $x(k) = u_s(k)$.

(b) $h(k) = \begin{cases} 1, & k = 0 \\ 2, & k = 1 \\ 3, & k = 2 \\ 0 & \text{otherwise} \end{cases}$, $x(k) = u_s(k)$.

(c) $h(k) = u_s(k)$, $x(k) = (1/2)^k u_s(k) + \delta(k)$.

(d) $h(k) = (1/2)^k \cos(k\pi/4) u_s(k)$, $x(k) = u_s(k)$.

(e) $H(E) = \dfrac{2}{E-2}$, $x(k) = k \cdot u_s(k)$.

(f) $H(z) = \dfrac{z}{(z-0.25)^2}$, $X(z) = \dfrac{z}{z-0.25}$.