大同大學 九十一 學年度研究所碩士班入學考試試題

考試科目:數位信號處理　　所別:電機工程研究所　　第1/1頁

註:本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 不可以使用計算器。

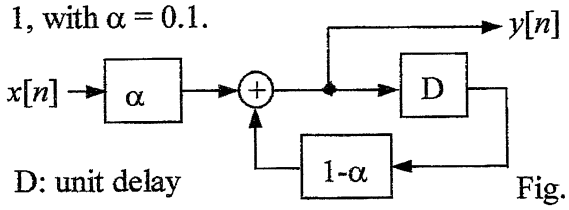
1. Determine if each of the following systems is stable, causal, linear, time-invariant, and memoryless: (16%)

   (a) $F(x[n]) = e^{x[n]}$　　(b) $F(x[n]) = x[-n]$

2. Consider the discrete-time filter shown in Fig. 1, with $\alpha = 0.1$.

   (a) Determine $H(z)$, the z-transform of the system impulse response.

   (b) Determine $y[n]$, if input $x[n]$ is a unit step sequence, $u[n]$. (16%)



D: unit delay　　Fig. 1

3. A causal linear time-invariant system has the system function $H(z) = \dfrac{1+2z^{-1}+z^{-2}}{(1+\frac{1}{2}z^{-1})(1-z^{-1})}$

   (a) Find the impulse response of the system, $h[n]$.

   (b) Find the output of this system, $y[n]$, for the input, $x[n] = e^{j(\pi/2)n}$　(16%)

4. Consider the system shown in Fig. 2. The input signal has the Fourier transform shown in Fig. 3 with $\Omega_0 = 2\pi(1000)$ radians/sec. The discrete-time system is an ideal low-pass filter with frequency response. $H(e^{j\omega}) = \begin{cases} 1, & |\omega| < \omega_c \\ 0, & otherwise \end{cases}$

   What is the minimum sampling rate $F_s = 1/T$ such that no aliasing occurs in sampling the input? What is the minimum sampling rate such that $y_c(t) = x_c(t)$, (16%) If $\omega_c = \pi/2$?

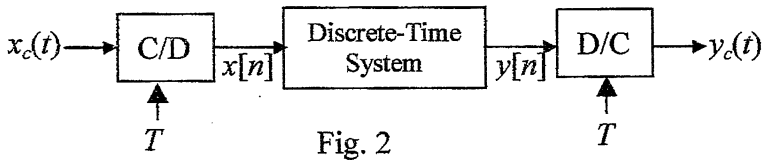


Fig. 2

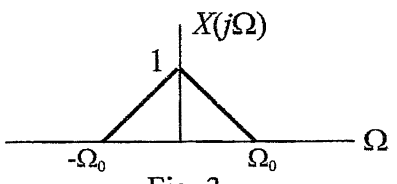


Fig. 3

5 Find the impulse response of the system shown in Fig. 4, which is composed of three identical linear time-invariant systems. The impulse response of the three systems are $h_1[n] = h_2[n] = h_3[n] = (0.8)^n u[n]$. (16%)

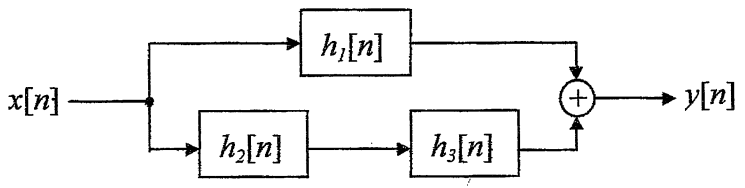


Fig. 4

6 Consider a distorting system, $H_d(z) = \dfrac{1+3z^{-1}}{1+\frac{1}{2}z^{-1}}$, which is stable but not of minimum phase. Find a compensating system $H_c(z)$ that compensates the frequency-response magnitude, i.e., $|S_c(e^{j\omega})| = |S(e^{j\omega})|$. (20%)