Digital signal processing-2006

Question 1

Answer all questions: [2×10

(a)

What kind of signal a periodic sine wave is? Why?

(b)

Find the impulse response of the discrete system being represented as

$$Y(n)=\alpha_1 x(n)+ \alpha_2 x(n-1)+ \alpha_3 x(n-3)+ \alpha_4 x(n-4)$$

Where y(n) is the system output and x(n) is the input to the system.

(c)

Give a block schematic representation of the linear convolution of two sequences x(n) and h(n).

(d)

Find the condition under which the causal LTI discrete time system with an impulse response $h(n)=\alpha^n u(n)$, where u(n) is a unit step sequence is BIBO stable.

(e)

Show that $r_{xy}(l)=r_{xy}(-l)$

(f)

Bring out the relationship between the correlation and the convolution of two sequences x(n) and y(n).

(g)

Find out the fourier transform of a unit sample sequence δ(n). plot it.

(h)

What is the bandwidth of a signal occupying the frequency range $0<w_L<=|w|<=w_H<\prod$?

(i)

What is the DTFT of $r_{xy}(l)$ where x is a real sequence?

(j)

What is the condition for convergence of the z-transform of a sequence x(n)?

Question 2 [5

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(b)

If one LTI system excited with input

$X(n)=2$ if n=-1 otherwise 0

And impulse response given by

$H(n)=\delta(n)-\delta(n-1)+\delta(n-4)+\delta(n-5)$

Then find out the output response of the system. [5

Question 3

(a)

Explain the ITR filter design using impulse invariance method. [6

(b)

Determine H(z) if H(s)=10/(s+2) and sampling time 0.01sec. Calculate magnitude and phase of H(z) at f/4 and f/2where f_s= sampling frequency. [4

Question 4

(a)

Find the z-transform of

$X(n)=r^n\cos(w_0n)u(n)$, where u(n) is a unit step function. Use certain properties of the z-transform to find the transform do not use the direct method of finding the transform. State the properties. [6

(b)

Explain why the z-transform exists for a unit step sequence, while its fourier transform does not exist from the point of view of uniform convergence. [4

Question 5

(a) [5

Compute the N-point DFT of the length N sequence

$X(n)=\cos(2\pi rn/N)$ $0<=n<=N-1$, $0<=r<=N-1$

(b)

Compute the DTFT of the sequence

$Y(n)=(n+1)\alpha^n u(n)$ $|\alpha|1$

Question 6

(a)

Describe the decimation-in-time algorithm as used in FFT computation of a sequence x(n). show the steps clearly. What is the advantage of it? [5

(b)

Perform circular convolution of a finite sequence $x_2(n)$ of length N and a sequence $x_1(n)=\delta(n-n_0)$ where $0<=n_0<=N$, $N=5$, $n_0=1$. Show all the steps clearly. [5

Question 7

(a)

In the estimation of spectrum of a finite duration signal, when the estimate is said to be consistent? Establish the condition of consistency. [5

(b)

Compare the nonrecursive and the recursive realization of a FIR moving average system. [5