Homework #0

28 Tháng Sáu 2019   9:37 CH

1. Continuous-Time Sinusoidal Generation.

a.

$c(t) = sin(2\pi f ct)rect(t - ½)$

$C(f) = F\{c(t)\} = F\{sin(2\pi f ct)rect(t - ½)\}$

$C(f) = F\{sin(2\pi f ct)\} * F\{rect(t - ½)\}$ $F\{w1(t)w2(t)\} = W1(f) * W2(f)$

$F\{Asin(2\pi f0t + \phi)\} = j\frac{A}{2}[-e^{-i\phi}\delta(f - f0) + e^{-i\phi}\delta(f + f0)]$

$*/ F\{sin(2\pi f ct)\} = j\frac{1}{2}[\delta(f + f0) - \delta(f - f0)]$

$F\{rect(t)\} = T\ sinc(fT)$ & $F\{w(t - t0)\} = W(f)\ e^{-j2\pi f t0}$

$*/F\{rect(t - 1/2)\} = e^{-j\pi f} sinc(f)$

$\Rightarrow C(f) = j\frac{1}{2}[\delta(f + f0) - \delta(f - f0)]\ e^{-j\pi f} sinc(f)$

$w(t) * \delta(t + a) = w(t + a)$

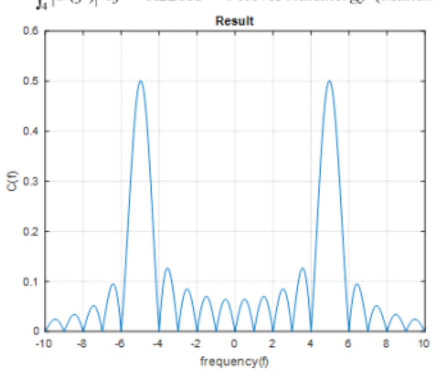
$$\boxed{C(f) = j\frac{1}{2}[\ e^{-j\pi(f+f0)} sinc(f + f0) - e^{-j\pi(f-f0)} sinc(f - f0)]}$$

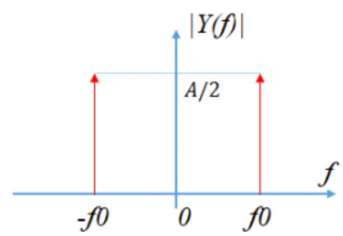
c.

Bandwith of c(t) = 2Hz (4 – 6Hz)   Bandwith of two-side sine = 0

$\text{Total Energy} = \int_0^\infty |C(f)|^2 df = 0.25J\ (Matlab)$

$\int_4^6 |C(f)|^2 df = 0.2265J = 90.6\% TotalEnergy\ (Matlab)$





$F\{Asin(2\pi f ct)\} = j\frac{A}{2}[\delta(f + f0) - \delta(f - f0)]$

2. Downconversion.

a.

$$y(t) = x(t)\cos(\omega 0t)$$

$$\Rightarrow Y(f) = F\{y(t)\} = X(f) * F\{\cos(\omega 0t)\}$$

$$F\{\cos(\omega 0t)\} = \frac{1}{2}[\delta(f + f0) + \delta(f - f0)]$$

$$Y(f) = X(f) * \frac{1}{2}[\delta(f + f0) + \delta(f - f0)]$$

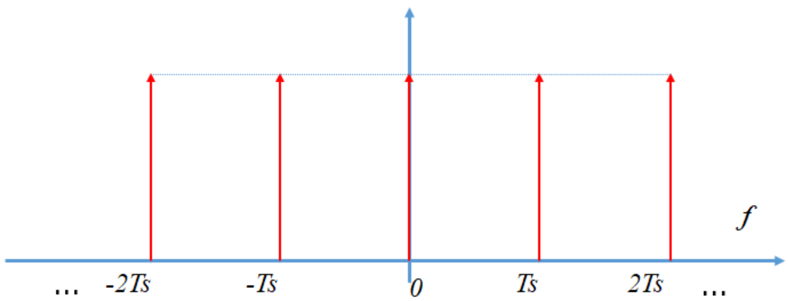
$$Y(f) = \frac{1}{2}[X(f) * \delta(f + f0) + X(f) * \delta(f - f0)]$$

$$\boxed{Y(f) = \frac{1}{2}[X(f + f0) + X(f - f0)]}$$

3. Sampling in Continuous Time.

a,b.

$$p(t) = \sum_{n=-\infty}^{\infty} \delta(t - nTs)$$



Period = Ts (The sampling duration)

x(t) = x(t + nTs)

c.

$$p(t) = \frac{1}{Ts}(1 + 2\cos(\omega_s t) + 2\cos(2\omega_s t))$$

$$F\{\cos(\omega_s t)\} = \pi[\delta(\omega + \omega_s) + \delta(\omega - \omega_s)]$$

$$F\{1\} = 2\pi\delta(\omega)$$

$$= \frac{2\pi}{Ts}(\delta(\omega) + \delta(\omega + \omega_s) + \delta(\omega - \omega_s) + \delta(\omega + 2\omega_s)$$

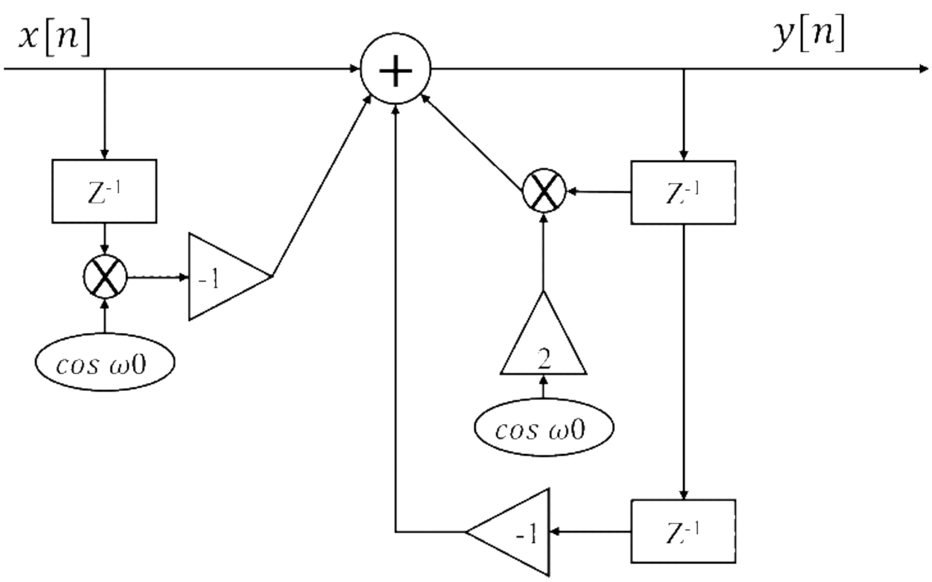
$$+ \delta(\omega - 2\omega_s) \dots)$$

$$\boxed{p(t) = \omega_s \sum_{n=-\infty}^{\infty} \delta(\omega + n\omega_s)}$$

4. Discrete-Time Sinusoidal Generation.

a.

$$y[n] = (2cos\omega 0)y[n-1] - y[n-2] + x[n] - (cos\omega 0)x[n-1]$$



b.

The intital condition is zero

c.

$y[n] = (2\cos\omega_0)\, y[n-1] - y[n-2] + x[n] - (\cos\omega_0)\, x[n-1]$

$Y(z) = (2\cos\omega_0)\, z^{-1}Y(z) - z^{-2}Y(z) + X(z) - (\cos\omega_0)\, z^{-1}X(z)$

$$H(z) = \frac{Y(z)}{X(z)} = \frac{1 - (cos\omega_0)z^{-1}}{1 - 2(cos\omega_0)z^{-1} + z^{-2}}$$