Name: Key

EE322 Fall 2012 Quiz 6

1. Find the CTFT of:

a. $x(t) = te^{-3t}u(t)$ $X(f)=$ $\frac{1}{(3+j2\pi f)^2}$

$$te^{at}u(t) \longleftrightarrow \frac{1}{(a+j2\pi f)^2}$$

$$a = 3$$

b. $x(t) = e^{-j2\pi 10t}$ $X(f)=$ $\delta(f+10)$

$$e^{j2\pi f_0 t} \longleftrightarrow \delta(f-f_0)$$

$$f_0 = -10$$

c. $x(t) = \sin 80\pi t = \sin 2\pi 40 t$ $X(f)=$ $\frac{j}{2}\left[\delta(f+40) - \delta(f-40)\right]$

$$\sin(2\pi f_0 t) \rightarrow \frac{j}{2}\left[\delta(f+f_0) - \delta(f-f_0)\right]$$

2. Find the inverse CTFT of:

a. $X(f) = \dfrac{1}{(1+j2\pi f)(5+j2\pi f)}$ $x(t)=$ $\frac{e^{-t} - e^{-5t}}{4}u(t)$

$$\frac{e^{-at} - e^{-bt}}{b-a}u(t) \longleftrightarrow \frac{1}{(a+j2\pi f)(b+j2\pi f)} \quad \begin{matrix} a=1 \\ b=5 \end{matrix}$$

b. $X(f) = \dfrac{1}{(2+j2\pi f)^2}$ $x(t)=$ $te^{-2t}u(t)$

$$te^{-at}u(t) \longleftrightarrow \frac{1}{(a+j2\pi f)^2}$$

$$a = 2$$

(turn over)

3. Using a fundamental period of $T_F = 1/75$ sec, write the equation for the Fourier Series Harmonic function for $x(t) = 3\cos(2\pi 150t) - 2\sin(2\pi 300t)$.

$$x(t) = 3\left(\tfrac{1}{2}e^{+j2\pi 150t} + \tfrac{1}{2}e^{-j2\pi 150t}\right) - 2\,\frac{1}{2j}\left(e^{+j2\pi 300t} - e^{-j2\pi 300t}\right)$$

$$= \underbrace{\tfrac{3}{2}e^{j2\pi(2)75t}}_{k=2} + \underbrace{\tfrac{3}{2}e^{j2\pi(-2)75t}}_{k=-2} - \left(\underbrace{\tfrac{1}{j}e^{j2\pi 4(75)t}}_{k=4} - \underbrace{e^{j2\pi(-4)75t}}_{k=-4}\right)$$

$X[2] = \frac{3}{2}$

$X[-2] = \frac{3}{2}$

$X[4] = -\frac{1}{j} = j$

$X[-4] = \frac{1}{j} = -j$

$X[k] =$ $\frac{3}{2}\delta[k-2] + \frac{3}{2}\delta[k+2] + j\delta[k-4] - j\delta[k+4]$

Bonus: Who is SpongeBob SquarePants' best friend?

Patrick (a ~~sea~~ starfish)