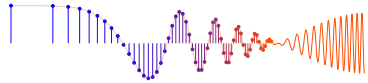


PROBLEM:

In each of the following problems, find the Fourier transform, or inverse Fourier transform. Give your answer as a simple formula or plot. (The symbol $*$ denotes covolution.)

(a) Find $Y(j\omega)$ when $y(t) = h(t) * x(t) = \cos(t) * \delta(t-2)$.

(b) Find $h(t)$ when $H(j\omega) = j\delta(\omega+1) * [\pi\delta(\omega) - \pi\delta(\omega-2)] + 2$.

(c) Find $v(t)$ when $V(j\omega) = \dfrac{j\omega}{9+3j\omega}$.

(d) Find $H(j\omega)$ when $h(t) = \dfrac{5\sin(2\pi(t-4))}{\pi(t-4)}$.

McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.

SOLUTION

In each of the following problems, find the Fourier transform, or inverse Fourier transform. Give your answer as a simple formula or plot.

(a) Find $Y(j\omega)$ when $y(t) = h(t) * x(t) = \cos(t) * \delta(t-2)$.

DELAY.

$$y(t) = \cos(t-2)$$

(b) Find $h(t)$ when $H(j\omega) = j\delta(\omega+1) * [\pi\delta(\omega) - \pi\delta(\omega-2)] + 2$.

$$= j\pi\delta(\omega+1) - j\pi\delta(\omega-1) + 2$$

$$h(t) = \sin t + 2\delta(t)$$

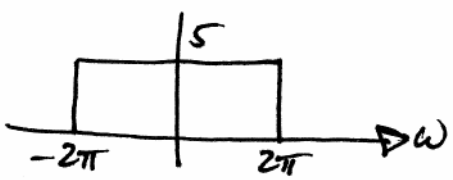
(c) Find $v(t)$ when $V(j\omega) = \dfrac{j\omega}{9+3j\omega}$. $= \dfrac{j\omega}{3}\left(\dfrac{1}{3+j\omega}\right)$

$$v(t) = \frac{1}{3}\frac{d}{dt}\left(e^{-3t}u(t)\right)$$

$$v(t) = -e^{-3t}u(t) + \frac{1}{3}\delta(t)$$

(d) Find $H(j\omega)$ when $h(t) = \dfrac{5\sin(2\pi(t-4))}{\pi(t-4)}$.

$$\frac{5\sin 2\pi t}{\pi t} \longleftrightarrow$$



$$H(j\omega) = \begin{cases} 5e^{-j4\omega}, & |\omega| < 2\pi \\ 0, & |\omega| > 2\pi \end{cases}$$