

Determine the CTFT of each of the following periodic signals:

(a)  $x(t) = \sin(2\pi t + \pi/4)$

Step 1: find CFS representation

$$x(t) = \frac{1}{2j} e^{j2\pi t} e^{j\pi/4} - e^{-j2\pi t} e^{-j\pi/4}$$

$$\xrightarrow{FS} X[k] = \frac{j e^{-j\pi/4}}{2} \delta[k+1] - \frac{j e^{j\pi/4}}{2} \delta[k-1] \quad \begin{matrix} T_F = 1 \\ f_F = 1 \end{matrix}$$

Step 2: apply Eq (10.18)

$$X(f) = \frac{e^{j\pi/4}}{2} \delta(f+1) + \frac{e^{-j\pi/4}}{2} \delta(f-1)$$

(b)  $x(t) = 1 + \cos(6\pi t + \pi/8)$

Once again, use a two step procedure

$$X(t) = 1 + \frac{e^{j\pi/8}}{2} e^{j6\pi t} + \frac{e^{-j\pi/8}}{2} e^{-j6\pi t} \quad \begin{matrix} T_F = 1/3 \\ f_F = 3 \end{matrix}$$

$$X[k] = \frac{e^{j\pi/8}}{2} \delta[k+1] + \delta[k] + \frac{e^{-j\pi/8}}{2} \delta[k-1]$$

$$X(f) = \frac{e^{j\pi/8}}{2} \delta(f+3) + \delta(f) + \frac{e^{-j\pi/8}}{2} \delta(f-3)$$