

1. 다음 신호를 graphical spectrum representation으로 나타내시오.

$$x(t) = 4 + 2 \cos(100\pi t + \frac{\pi}{2}) - 3 \sin(50\pi t - \frac{\pi}{4})$$

i.

$$4 = 4e^{j2\pi(0)t}$$

ii.

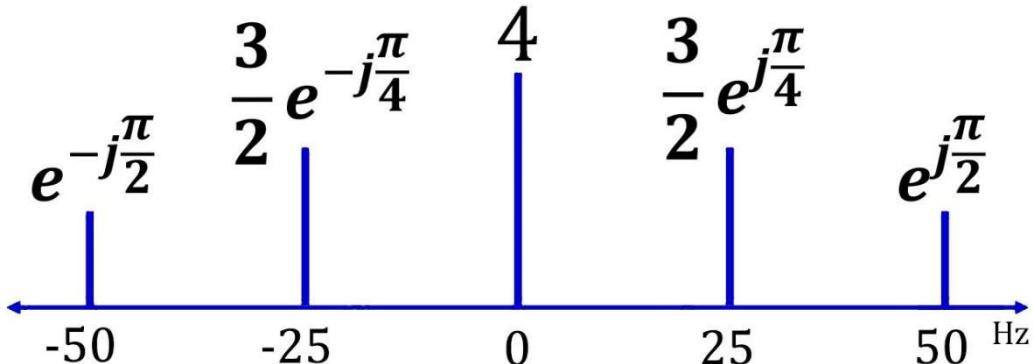
$$\begin{aligned} 2 \cos\left(100\pi t + \frac{\pi}{2}\right) &= 2 \cos\left(2\pi(50)t + \frac{\pi}{2}\right) \\ &= 2\left(\frac{1}{2}e^{j(2\pi(50)t + \frac{\pi}{2})} + \frac{1}{2}e^{-j(2\pi(50)t + \frac{\pi}{2})}\right) \\ &= e^{j(2\pi(50)t + \frac{\pi}{2})} + e^{-j(2\pi(50)t + \frac{\pi}{2})} \\ &= e^{j\frac{\pi}{2}}e^{j2\pi(50)t} + e^{-j\frac{\pi}{2}}e^{-j2\pi(50)t} \end{aligned}$$

iii.

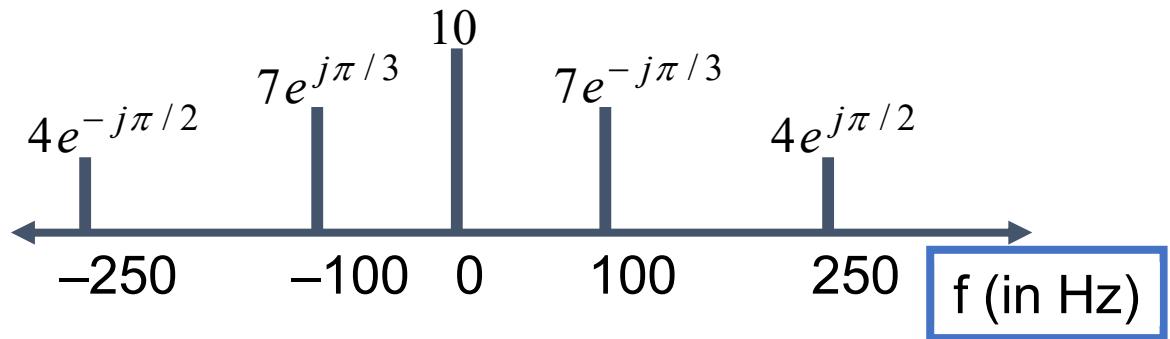
$$\begin{aligned} -3 \sin\left(50\pi t - \frac{\pi}{4}\right) &= -3 \sin\left(2\pi(25)t - \frac{\pi}{4}\right) \\ &= -3\left(\frac{1}{2j}e^{j(2\pi(25)t - \frac{\pi}{4})} - \frac{1}{2j}e^{-j(2\pi(25)t - \frac{\pi}{4})}\right) \\ &= -\frac{3}{2j}e^{j(-\frac{\pi}{4})}e^{j2\pi(25)t} + \frac{3}{2j}e^{-j(-\frac{\pi}{4})}e^{-j2\pi(25)t} \end{aligned}$$

에서 $-\frac{1}{j} = e^{j\frac{\pi}{2}}$, $\frac{1}{j} = e^{-j\frac{\pi}{2}}$ 으로,

$$\begin{aligned} &= \frac{3}{2}e^{j(\frac{\pi}{2}-\frac{\pi}{4})}e^{j2\pi(25)t} + \frac{3}{2}e^{-j(\frac{\pi}{2}-\frac{\pi}{4})}e^{-j2\pi(25)t} \\ &= \frac{3}{2}e^{j\frac{\pi}{4}}e^{j2\pi(25)t} + \frac{3}{2}e^{-j\frac{\pi}{4}}e^{-j2\pi(25)t} \end{aligned}$$



2. 다음 graphical spectrum representation를 신호로 표현하시오.



i.

$$10e^{j2\pi(0)t} = 10$$

ii.

$$7e^{-j\frac{\pi}{3}}e^{j2\pi(100)t} + 7e^{j\frac{\pi}{3}}e^{-j2\pi(100)t} = 14 \cos\left(2\pi(100)t - \frac{\pi}{3}\right) = 14 \cos\left(200\pi t - \frac{\pi}{3}\right)$$

iii.

$$4e^{j\frac{\pi}{2}}e^{j2\pi(250)t} + 4e^{-j\frac{\pi}{2}}e^{-j2\pi(250)t} = 8 \cos\left(2\pi(250)t + \frac{\pi}{2}\right) = 8 \cos\left(500\pi t + \frac{\pi}{2}\right)$$

$$x(t) = 10 + 14 \cos\left(200\pi t - \frac{\pi}{3}\right) + 8 \cos\left(500\pi t + \frac{\pi}{2}\right)$$