信号理論基礎　後半(1)　課題　20315784　佐藤浚雅

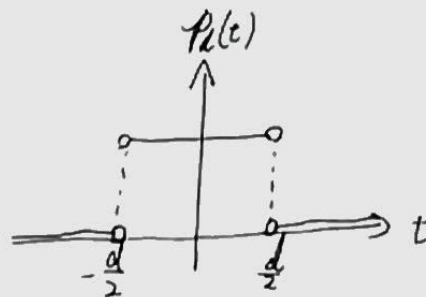問題 4.10 (p.94)

$$p_d(t) = \begin{cases} 1 & |t| < \frac{1}{2}d \\ 0 & |t| > \frac{1}{2}d \end{cases}$$

$$F(\omega) = F\left[p_d(t)\right] = \int_{-\infty}^{\infty} p_d(t)e^{-j\omega t}dt$$

$$= \int_{-\frac{d}{2}}^{\frac{d}{2}} e^{-j\omega t}dt$$

$$= -\frac{1}{j\omega}\left[e^{-j\omega t}\right]_{-\frac{d}{2}}^{\frac{d}{2}}$$

$$= -\frac{1}{j\omega}\left(e^{-j\omega\frac{d}{2}} - e^{j\omega\frac{d}{2}}\right)$$

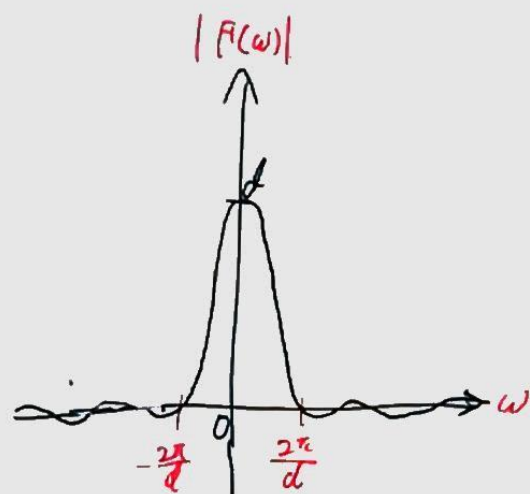$$= \frac{1}{j\omega}\left(e^{+j\omega\frac{d}{2}} - e^{-j\omega\frac{d}{2}}\right)$$

$$= \frac{1}{j\omega} \cdot 2j \sin\left(\frac{d}{2}\omega\right)$$

$$= \frac{2}{\omega}\sin\left(\frac{\omega d}{2}\right)$$

$$= \frac{1}{\frac{\omega}{2}}\sin\left(\frac{\omega d}{2}\right)$$

$$= \frac{d}{\frac{\omega d}{2}}\sin\left(\frac{\omega d}{2}\right)$$

$$= d \, \text{sinc}\left(\frac{\omega d}{2}\right)$$

问题 5.7 (p128)

$$F[1] = 2\pi \delta(\omega), \quad F[f(t) e^{j\omega_0 t}] = F(\omega - \omega_0)$$

$$F[e^{j\omega_0 t}] = 2\pi \delta(\omega - \omega_0)$$

问题 5.8 (p128)

$$\cos \omega_0 t = \frac{1}{2}(e^{j\omega_0 t} + e^{-j\omega_0 t})$$

$$F[\cos \omega_0 t] = F\left[\frac{1}{2}(e^{j\omega_0 t} + e^{-j\omega_0 t})\right]$$

$$= \frac{1}{2} F[e^{j\omega_0 t}] + \frac{1}{2} F[e^{-j\omega_0 t}]$$

$$= \frac{1}{2} \cdot 2\pi \delta(\omega - \omega_0) + \frac{1}{2} \cdot \delta(\omega + \omega_0)$$

$$= \pi \left(\delta(\omega - \omega_0) + \delta(\omega + \omega_0) \right)$$

$$\sin \omega_0 t = \frac{1}{2j}(e^{j\omega_0 t} - e^{-j\omega_0 t})$$

$$F[\sin \omega_0 t] = F\left[\frac{1}{2j}(e^{j\omega_0 t} - e^{-j\omega_0 t})\right]$$

$$= \frac{1}{2j} F[e^{j\omega_0 t}] - \frac{1}{2j} F[e^{-j\omega_0 t}]$$

$$= \frac{1}{2j} 2\pi \delta(\omega - \omega_0) - \frac{1}{2j} 2\pi \delta(\omega + \omega_0)$$

$$= -j\pi \left(\delta(\omega - \omega_0) - \delta(\omega + \omega_0) \right)$$

$$= j\pi \left(\delta(\omega + \omega_0) - \delta(\omega - \omega_0) \right)$$