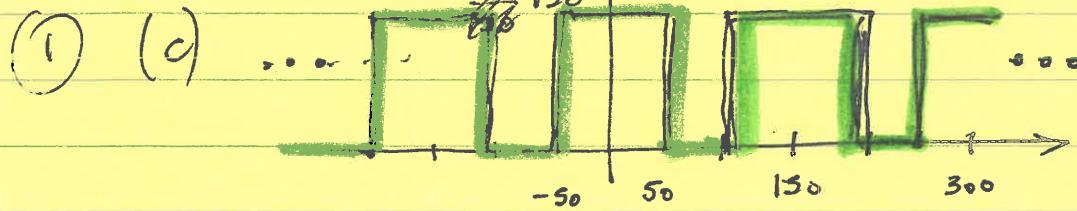


$$x(t) = 100 \operatorname{sinc}(100t) \longleftrightarrow \Pi\left(\frac{t}{100}\right), f_{s,\min} = 2W = 100 \text{ (a)}$$

$\uparrow X_s(f)$

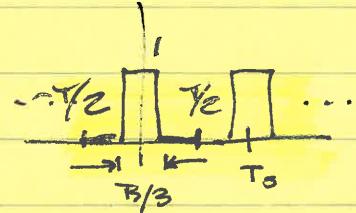
$$f_s = 150 \text{ (b)}$$



$$X_s(f) = f_s \sum_{n=-\infty}^{\infty} X(f-nf_s)$$

②

$$x_s(t) = x(t) \sum_{n=-\infty}^{\infty} \Pi\left(\frac{t-nT_s}{\tau}\right)$$



$$X_s(f) = X(f) * \sum_{n=-\infty}^{\infty} \frac{1}{3} \operatorname{sinc}\left(\frac{n}{3}\right) \delta(f-nf_s)$$

$$\rightarrow X_s(f) = \frac{1}{3} \sum_{n=-\infty}^{\infty} \operatorname{sinc}\left(\frac{n}{3}\right) X(f-nf_s)$$

FS coefficient

$$x_n = \frac{1}{T} \int_{-\pi/2}^{\pi/2} x(t) e^{j2\pi \frac{n}{T} t} dt = \frac{1}{T} \int_{-\pi/2}^{\pi/2} e^{j2\pi \frac{n}{T} t} dt$$

$$= \frac{\tau}{T} \operatorname{sinc}\left(\frac{n\tau}{T}\right), \quad \tau = \frac{T_0}{3} : \boxed{x_n = \frac{1}{3} \operatorname{sinc}\left(\frac{n}{3}\right)}$$

2/3

$$(3) \quad x_s(t) = \sum_{n=-\infty}^{\infty} x(nT_s) \Pi\left(\frac{t-nT_s}{\tau}\right)$$

$$= \sum_{n=-\infty}^{\infty} [x(t) \delta(t-nT_s)] * \Pi\left(\frac{t}{\tau}\right)$$

$$= \left[x(t) \sum_{n=-\infty}^{\infty} \delta(t-nT_s) \right] * \Pi\left(\frac{t}{\tau}\right)$$

$$\leftrightarrow f_s \sum_{n=-\infty}^{\infty} X(f-nf_s) \cdot \tau \operatorname{sinc}(\tau f)$$

$$x_s(t) = \sum_{n=-\infty}^{\infty} x(nT_s) \Pi\left(\frac{t-nT_s}{\tau}\right)$$

$$= \sum_{n=-\infty}^{\infty} x(nT_s) [\delta(t-nT_s) * \Pi\left(\frac{t}{\tau}\right)]$$

$$= \sum_{n=-\infty}^{\infty} [x(t) [\delta(t-nT_s)]] * \Pi\left(\frac{t}{\tau}\right)$$

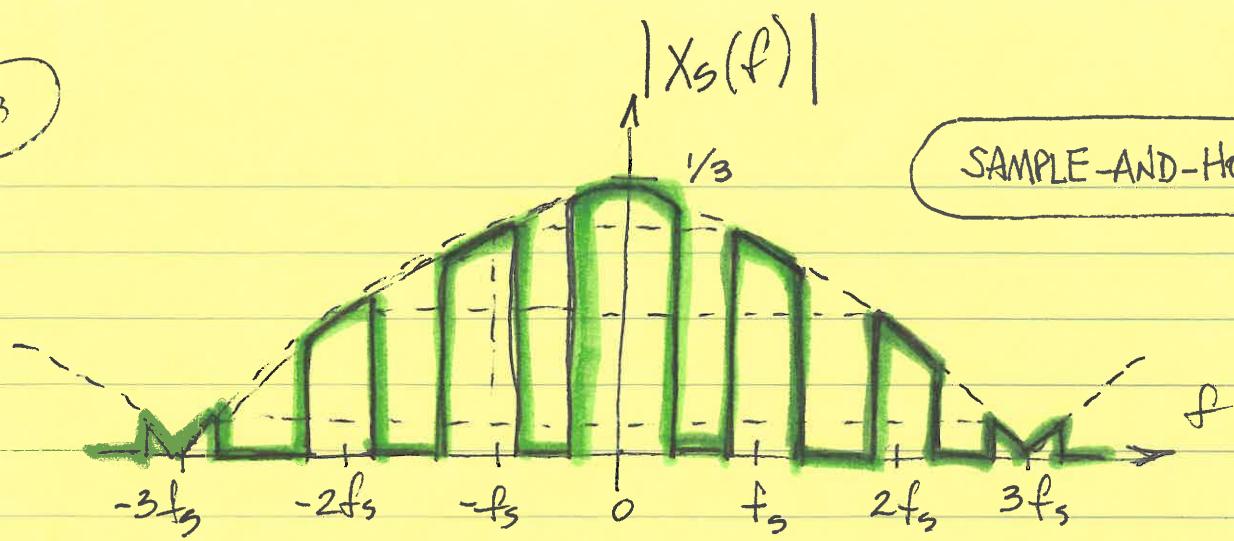
$$\Leftrightarrow X_s(f) = \left[f_s \sum_{n=-\infty}^{\infty} X(f-nf_s) \right] \cdot \tau \operatorname{sinc}(\tau f)$$

$$= \frac{1}{3} \left[\sum_{n=-\infty}^{\infty} X(f-nf_s) \right] \sin\left(\frac{\pi f}{3f_s}\right), \quad \tau = \frac{T_s}{3} = \frac{1}{3f_s}$$

$$\Rightarrow X_s(f) = \frac{1}{3} \sin\left(\frac{f}{3f_s}\right) \sum_{n=-\infty}^{\infty} X(f-nf_s)$$

(3)

3/3

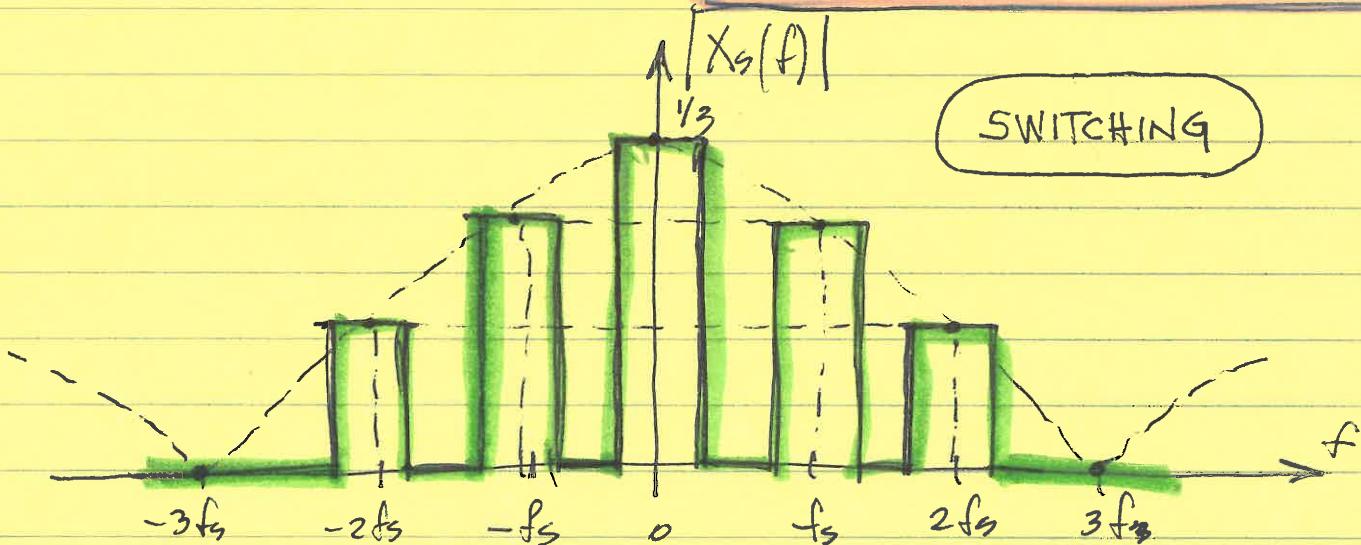


SAMPLE-AND-HOLD

(2)

$$x_s(t) = x(t) \sum_{n=-\infty}^{\infty} \Pi\left(\frac{t-nT_s}{2}\right) \leftrightarrow X_s(f) = X(f) * \frac{1}{3} \sum_{n=-\infty}^{\infty} \text{sinc}\left(\frac{n}{3}\right) \delta(f-nf_s)$$

$$X_s(f) = \frac{1}{3} \sum_{n=-\infty}^{\infty} \text{sinc}\left(\frac{n}{3}\right) X(f-nf_s)$$



SWITCHING