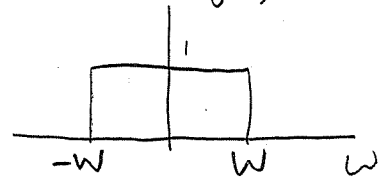


Example using the CTFT Synthesis integral

Take the inverse Fourier Transform of

$$X(j\omega) = \begin{cases} 1, & |\omega| < W \\ 0, & |\omega| > W \end{cases}$$



Solution: Plug  $X(j\omega)$  into Eq (10.5) on p.342

$$X(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} X(j\omega) e^{j\omega t} d\omega$$

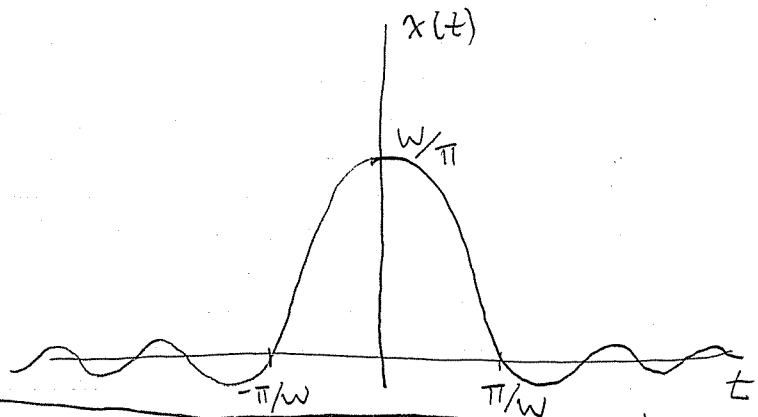
$$= \frac{1}{2\pi} \int_{-W}^W (1) e^{j\omega t} d\omega$$

$$= \frac{1}{2\pi} \frac{1}{jt} e^{j\omega t} \Big|_{\omega=-W}^W$$

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

$$= \frac{\sin(Wt)}{\pi t}$$

$$X(t) = \frac{W}{\pi} \text{sinc}\left(\frac{W}{\pi} t\right)$$



When the bandwidth  $W$  is wide,  $x(t)$  is very brief  
When the bandwidth  $W$  is narrow,  $x(t)$  is very long