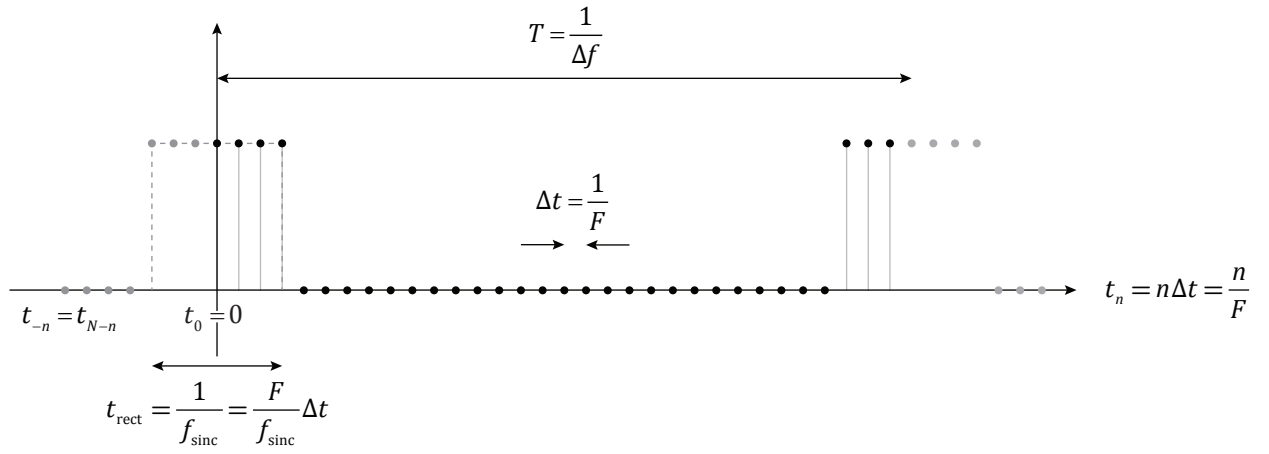
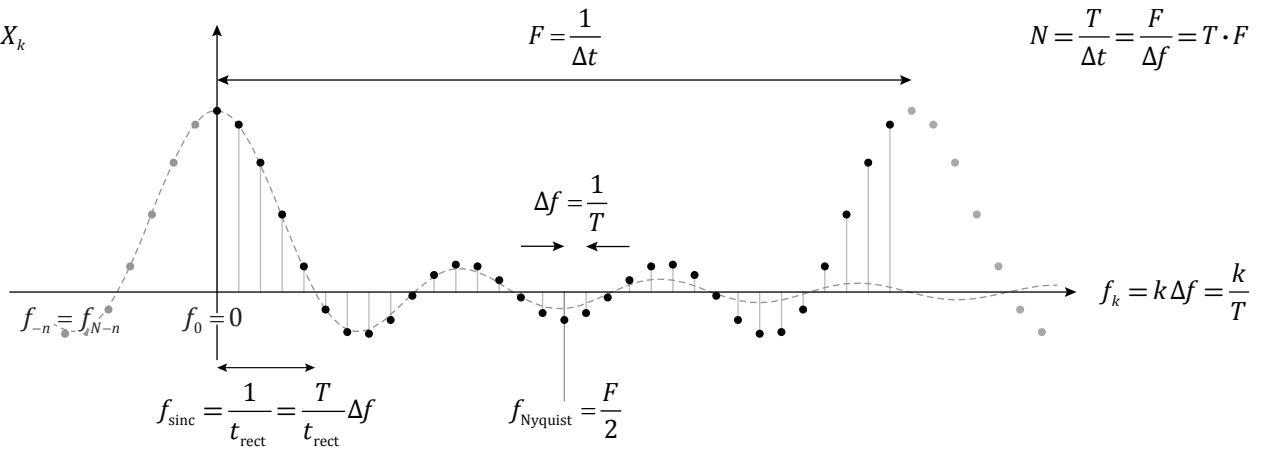


DFT Cheat Sheet



$$\sum_{n=0}^{N-1} X_n^* X_n = \sum_{k=0}^{N-1} X_k^* X_k$$



time domain

frequency domain

notes

$$x_n = x(t_n) = \frac{1}{\sqrt{N}} \sum_{k=0}^{N-1} X_k \exp(i2\pi f_k t_n)$$

$$= \frac{1}{\sqrt{N}} \sum_{k=0}^{N-1} X_k \exp\left(i2\pi \frac{kn}{N}\right)$$

$$X_k = X(f_k) = \frac{1}{\sqrt{N}} \sum_{n=0}^{N-1} x_n \exp(-i2\pi f_k t_n)$$

$$= \frac{1}{\sqrt{N}} \sum_{n=0}^{N-1} x_n \exp\left(-i2\pi \frac{kn}{N}\right)$$

$$f_k t_n = k\Delta f n\Delta t = \frac{kn}{N}$$

$$x_n \exp\left(i2\pi \frac{mn}{N}\right)$$

$$X_{(k-m) \bmod N}$$

(circular) frequency shift

$$X_{(n-m) \bmod N}$$

$$X_k \exp\left(-i2\pi \frac{mk}{N}\right)$$

(circular) time shift

$$x_n * y_n$$

$$X_k \cdot Y_k$$

convolution

$$x_n \cdot y_n$$

$$X_k * Y_k$$

$$x_n * y_n = \sum_{l=0}^{N-1} x_l y_{(n-l) \bmod N}$$

$$\delta_n$$

$$\frac{1}{\sqrt{N}}$$

$$\delta_n = \begin{cases} 1, & n=0 \\ 0, & n \neq 0 \end{cases}$$

$$\frac{1}{\sqrt{N}}$$

$$\delta_k$$

$$\cos\left(2\pi \frac{mn}{N}\right)$$

$$\frac{\sqrt{N}}{2} (\delta_{(k-m) \bmod N} + \delta_{(k+m) \bmod N})$$

$$\text{rect}(2M) = \text{rect}\left(\frac{t_{\text{rect}}}{\Delta t}\right)$$

$$\frac{1}{\sqrt{N}} \left(1 + 2 \sum_{m=1}^M \cos\left(2\pi \frac{km}{N}\right) \right)$$

$$\text{rect}(2M) = \begin{cases} 1, & |n| \leq M \\ 0, & |n| > M \end{cases}$$

(shown above for $M = 3$)