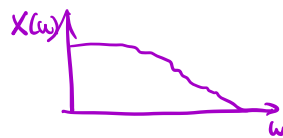


FT - Fourier Transform

$$X(\omega) = \int_{-\infty}^{\infty} x(t) \cdot e^{-j\omega t} dt$$

$$x(t) = \int_{-\infty}^{\infty} X(\omega) \cdot e^{j\omega t} d\omega$$

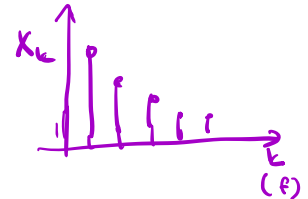
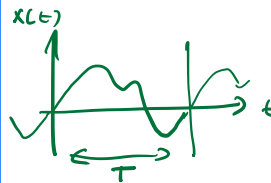


continuous $\leftrightarrow$ continuous
non-periodic $\leftrightarrow$ non-periodic

FS - Fourier Series

$$X_k = \frac{1}{T} \int_0^T x(t) \cdot e^{-j \frac{2\pi k \cdot t}{T}} dt$$

$$x(t) = \sum_{k=-\infty}^{\infty} X_k \cdot e^{j \frac{2\pi k \cdot t}{T}}$$

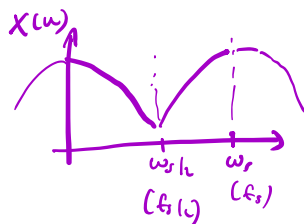
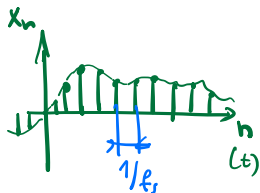


continuous $\leftrightarrow$ discrete
periodic $\leftrightarrow$ non-periodic

DtFT - Discrete time Fourier T.

$$X(\omega) = \sum_{n=-\infty}^{\infty} x_n \cdot e^{-j \frac{\omega \cdot n}{f_s}}$$

$$x_n = \frac{1}{\omega_s} \int_0^{\omega_s} X(\omega) \cdot e^{j \frac{\omega \cdot n}{f_s}} d\omega$$

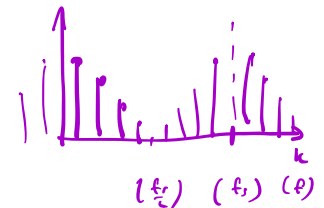
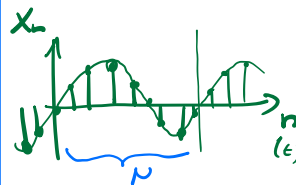


discrete $\leftrightarrow$ continuous
non-periodic $\leftrightarrow$ periodic

DFT - Discrete Fourier T.

$$X_k = \sum_{n=0}^{N-1} x_n \cdot e^{-j \frac{2\pi k \cdot n}{N}}$$

$$x_n = \frac{1}{N} \sum_{k=0}^{N-1} X_k \cdot e^{j \frac{2\pi k \cdot n}{N}}$$



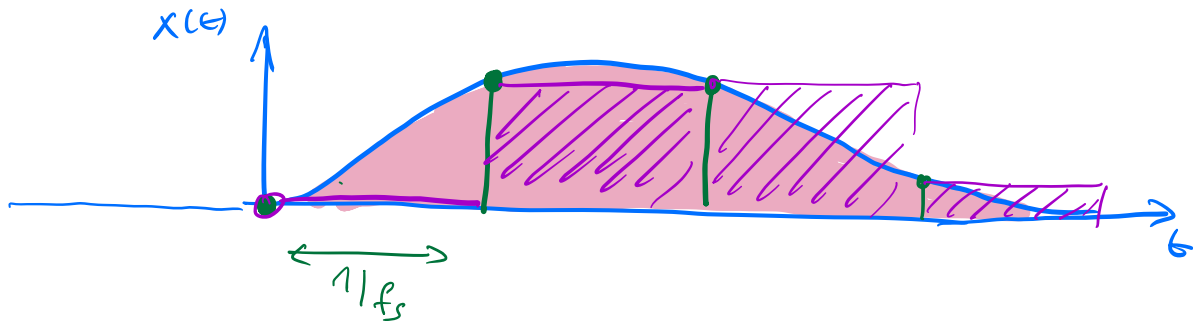
discrete $\leftrightarrow$ discrete
periodic $\leftrightarrow$ periodic

FFT - Fast Fourier Transform
= algorithm that implements the DFT



$$X(\omega) = \int_{-\infty}^{\infty} x(t) \cdot e^{-j\omega t} dt$$

$$X_k = \sum_{n=0}^{N-1} x_n \cdot e^{-j \frac{2\pi k \cdot n}{N}}$$



$$X(0) = \int_{-\infty}^{\infty} x(t) dt$$

$$X_{DC} = \sum_{n=0}^{N-1} x_n$$

NON-PERIODIC SIGNAL

$$\boxed{fft(x) / f_s} \leftarrow \text{FT approximation}$$

PERIODIC SIGNAL

$$fft(x) / (f_s \cdot T) = \boxed{fft(x) / N} \leftarrow \text{FS approximation}$$