VE216 Lecture 19

> Fourier Representations Relations

DT Fourier Series

$$a_k = a_{k+N} = \frac{1}{N}\sum_{n=<N>} x[n]e^{-j\frac{2\pi}{N}kn}$$

$$x[n] = x[n+N] = \sum_{k=<N>} a_k e^{j\frac{2\pi}{N}kn}$$

DT Fourier transform

$$X(e^{j\Omega}) = \sum_{n=-\infty}^{\infty} x[n]e^{-j\Omega n}$$

$$x[n] = \frac{1}{2\pi}\int_{<2\pi>} X(e^{j\Omega})e^{j\Omega n}d\Omega$$

CT Fourier Series

$$a_k = \frac{1}{T}\int_T x(t)e^{-j\frac{2\pi}{T}kt}dt$$

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

CT Fourier transform

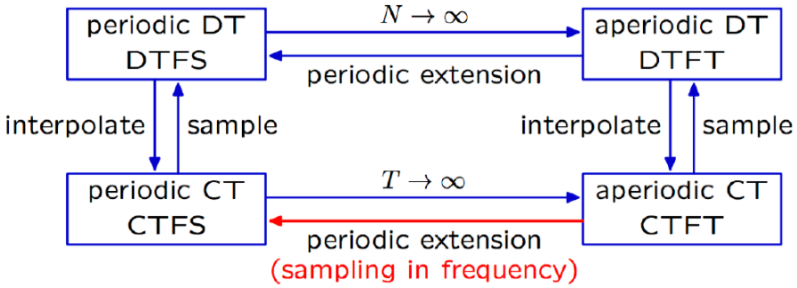
$$X(j\omega) = \int_{-\infty}^{\infty} x(t)e^{-j\omega t}dt$$

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

Relation between Fourier Transform and Series

$$X(j\omega) = \sum_{k=-\infty}^{\infty} 2\pi a_k \delta(\omega - k\omega_0)$$

Relation among Fourier Representations



Relation between CT and DT Transforms

$x_p(t) = x(t)p(t)$ where $p(t) = \sum_{k=-\infty}^{\infty} \delta(t + kT)$

$X(e^{j\Omega}) = \sum_n x[n]e^{-j\Omega n}$ and $X_p(j\omega) = \int x_p(t)e^{-j\omega t}dt = \sum_n x[n]e^{-j\omega nT}$

$\Omega = \omega T$