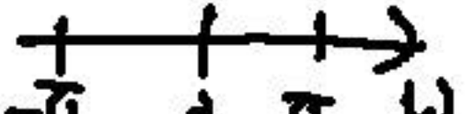
EECE 233 Fall 2014 Lec. #16

Announcement

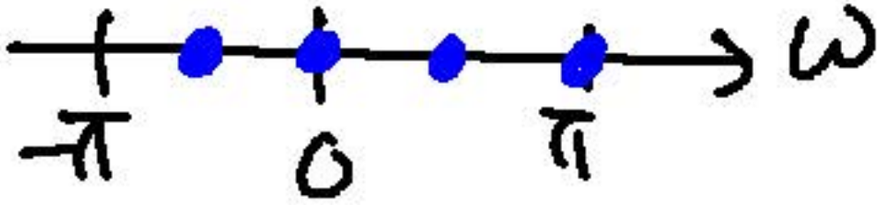
- Quiz on this Friday
- MATLAB " "

Review

LTI
- TD
  - $y[n] = x[n] * h[n]$
  - $y(t) = x(t) * h(t)$
- FD
  - $x[n] = \sum_{k=-\infty}^{\infty} a_k e^{j\omega_k n}$
  - $y[n] = \sum_{k=-\infty}^{\infty} a_k H(e^{j\omega_k}) e^{j\omega_k n}$

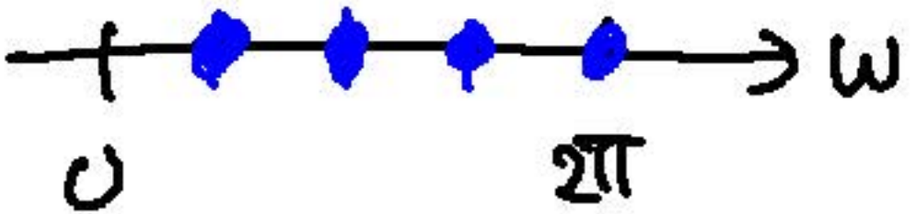


	DT	CT
till Midterm #1	$y[n] = x[n] * h[n]$	$y(t) = x(t) * h(t)$
#2	$x[n] = \sum_{k=\langle N \rangle} a_k e^{j\frac{2\pi k}{N}n}$ ↓ $y[n] = \sum_{k=\langle N \rangle} a_k H(e^{j\frac{2\pi k}{n}}) e^{j\frac{2\pi k}{N}n}$	$x(t) = \sum_{k=-\infty}^{\infty} a_k e^{j\frac{2\pi k}{T}t}$ ↓ $y(t) = \sum_{k=-\infty}^{\infty} a_k H(j\frac{2\pi k}{T}) e^{j\frac{2\pi k}{T}t}$



$x[n] = x[n+N], \forall n$

$N = 4$



$\omega_0 = \frac{2\pi}{4}$

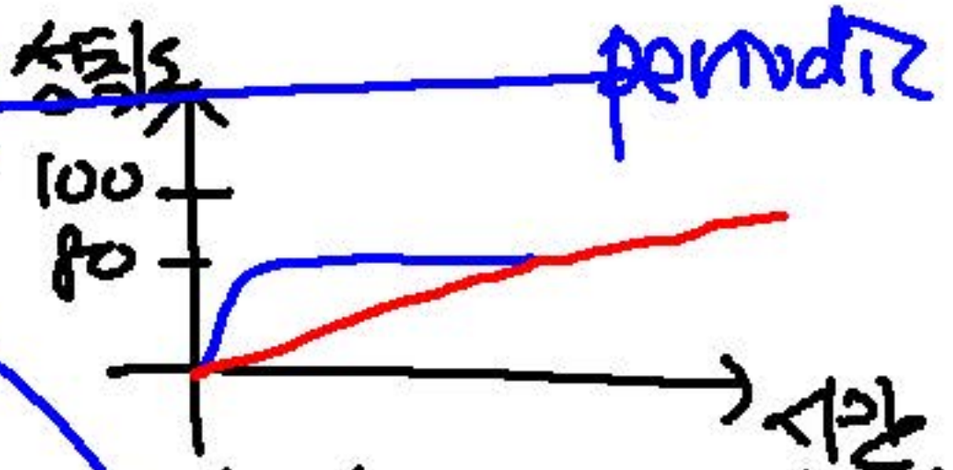
Q1 $x[n] = a_0 + a_1 e^{j\frac{2\pi}{4}n} + a_2 e^{j\frac{2\pi}{\sqrt{3}}n}$

This signal is periodic. T/F 1/2

when $a_i \neq 0 \ \forall i$

Q2. $x[n] = a_0 + a_1 e^{j\omega_0 n} + a_2 e^{j\omega_0 (2n)}$ $a_i \neq a \ \forall i$.

specialize
generalize

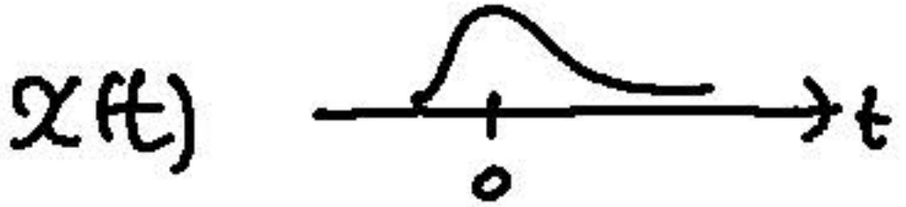


"You are a graduate student."

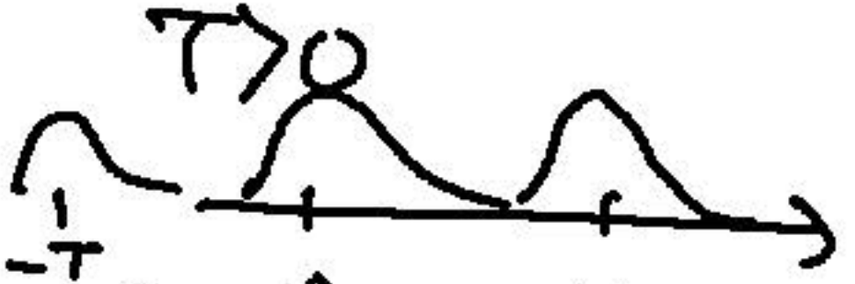
simplify
visualize.

experience
lesson.

non-periodic
aperiodic
typical ↔ atypical.



$$x_T(t) \triangleq \sum_{n=-\infty}^{\infty} x(t-nT),$$



(a) $$x_T(t+T) = \sum_{n=-\infty}^{\infty} x(t+T-nT)$$

$$= \sum_{n=-\infty}^{\infty} x(t-(n-1)T) \qquad n' = n-1$$

$$= \sum_{n'=-\infty}^{\infty} x(t-n'T) = x_T(t), \ \forall t$$

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

$$a_k = \frac{1}{T}\int_{\langle T \rangle} x_T(t)\, e^{-j\frac{2\pi kt}{T}}\, dt$$

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

$$a_0 = \frac{1}{T}\int_0^T x_T(t)\, dt$$

$$= \frac{1}{T}\int_0^T \sum_{n=-\infty}^{\infty} x(t-nT)\, dt$$

$$= \frac{1}{T}\sum_{n=-\infty}^{\infty}\int_0^T x(t-nT)\, dt$$

$$= \frac{1}{T}\sum_{n=-\infty}^{\infty}\int_{-nT}^{-nT+T} x(t)\, dt$$

$$= \frac{1}{T}\int_{-\infty}^{\infty} x(t)\, dt$$

Q.

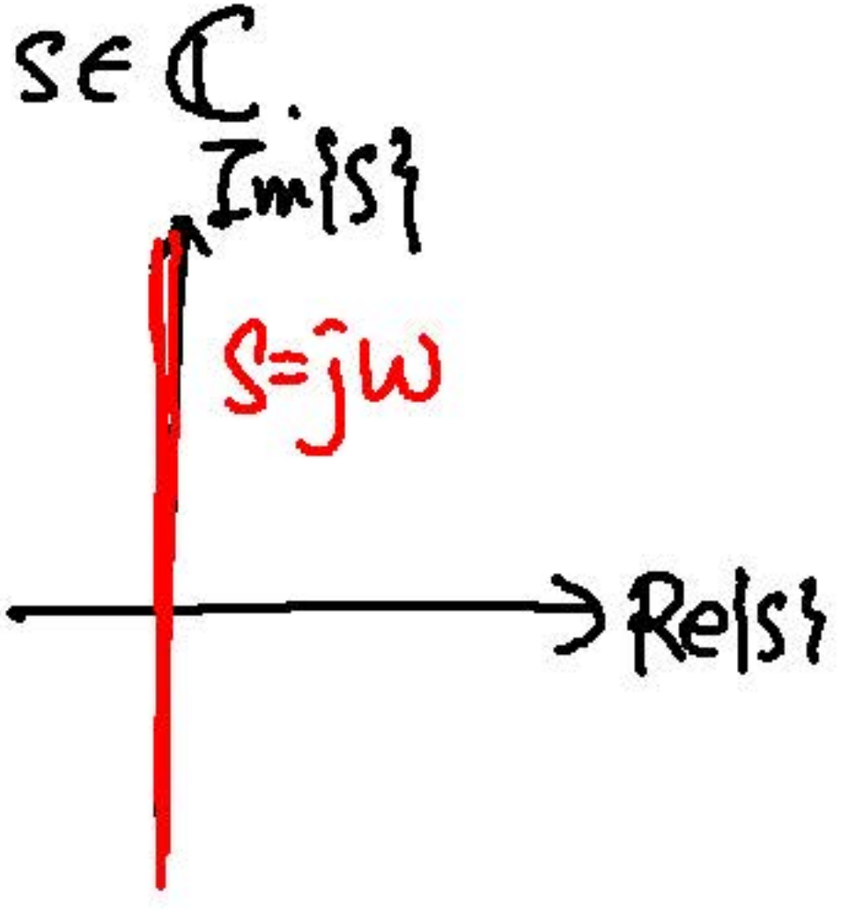
(f) $\lim_{m\to\infty}\left(\lim_{n\to\infty}\frac{m}{m+n}\right) \stackrel{?}{=} \lim_{n\to\infty}\left(\lim_{m\to\infty}\frac{m}{m+n}\right)$

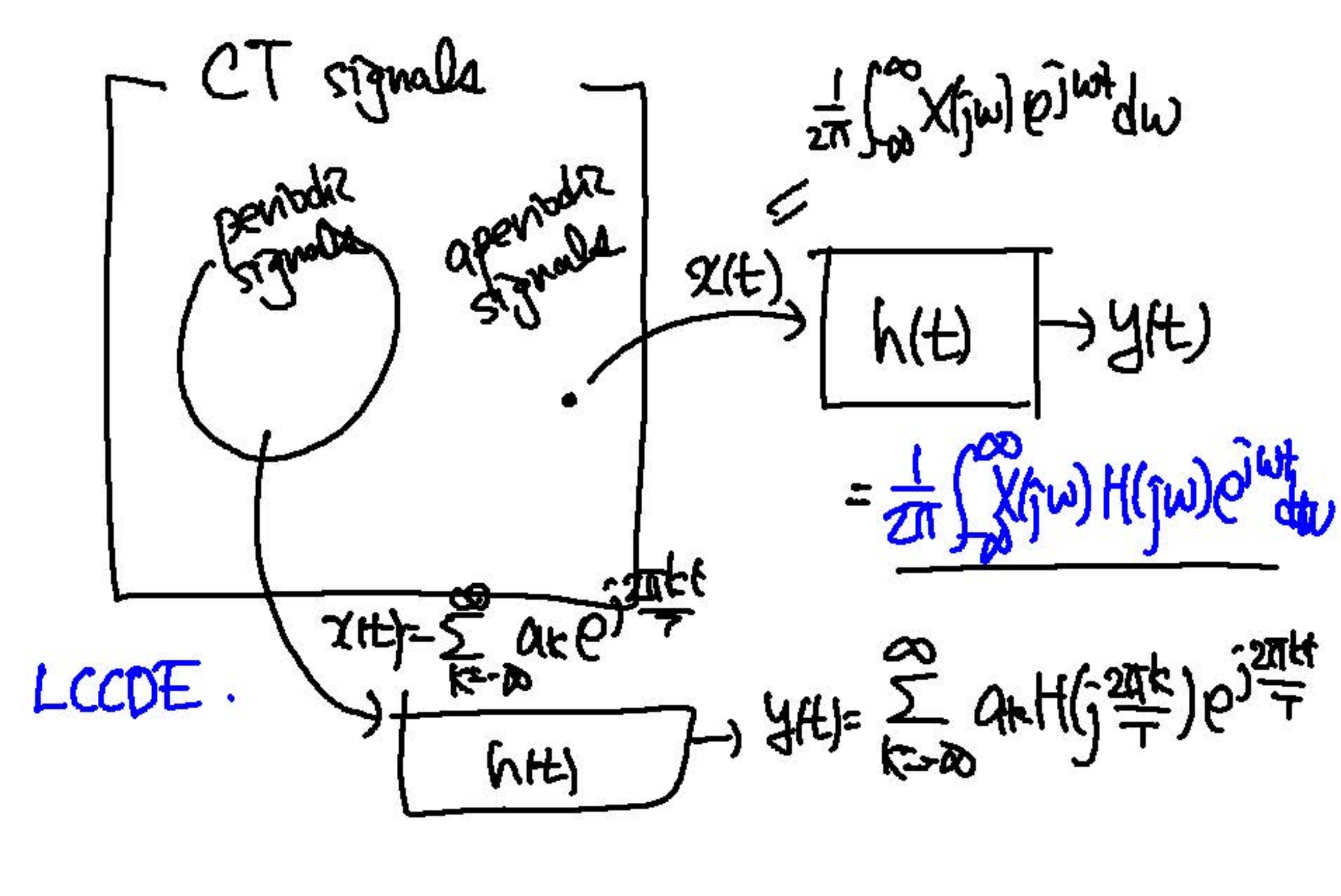
$x(t)$의 Laplace TF

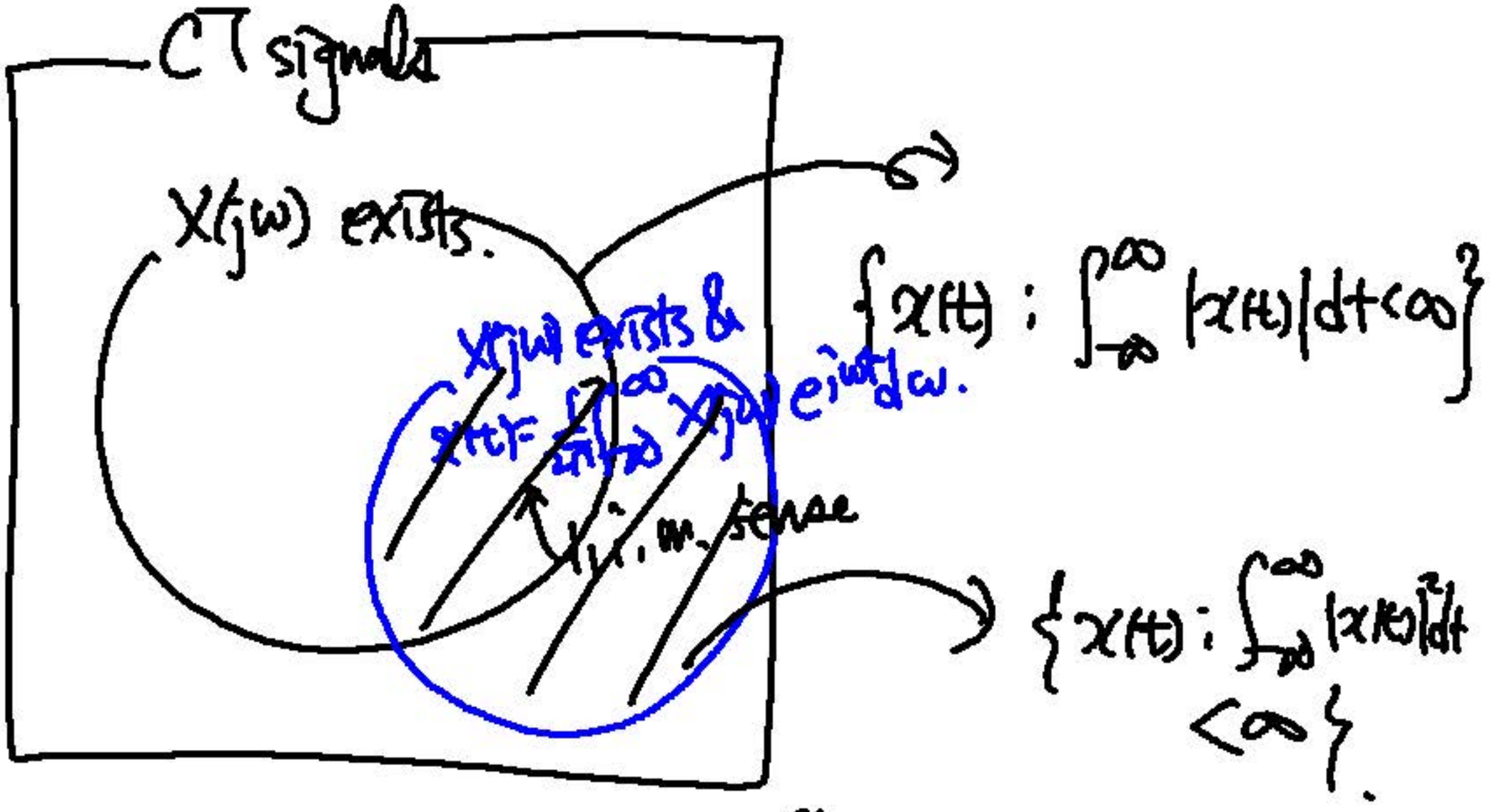
$$X(s) \triangleq \int_{-\infty}^{\infty} x(t) e^{-st} dt, \quad s \in \mathbb{C}.$$

$s = j\omega$ 에서 evaluate

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




CT signals
periodic signals
aperiodic signals
$\frac{1}{2\pi}\int_{-\infty}^{\infty} X(j\omega) e^{j\omega t} d\omega$
=
x(t)
h(t)
y(t)
$= \frac{1}{2\pi}\int_{-\infty}^{\infty} X(j\omega) H(j\omega) e^{j\omega t} d\omega$
$x(t) = \sum_{k=-\infty}^{\infty} a_k e^{j\frac{2\pi k t}{T}}$
LCCDE.
h(t)
$y(t) = \sum_{k=-\infty}^{\infty} a_k H(j\frac{2\pi k}{T}) e^{j\frac{2\pi k t}{T}}$



"Fourier TF, Inverse FT".

- Plancherel