✳ Chapter 4   CT Fourier Transform

Subject :

Representation :

CTFT
Synthesis formula

CTFT
Analysis formula

Comparison to CTFS.

CTFS : $\begin{cases} x(t) = \\ \\ a_k = \end{cases}$

The above equation represents $x(t)$ by the integral of test HRCE signals $e^{j\omega t}$ for different ω values.

Unfortunately, it is not the most common form in the FT literature. We need some modifications.

Modification:
Define:

* We say $X(j\omega)$ is the Fourier transform of $x(t)$. $x(t)$ is the inverse Fourier transform of $X(j\omega)$

Jointly $(x(t), X(j\omega))$ form a F.T. pair.

* We sometimes write

Example: Text Example 4.2

$$x(t) = e^{-a|t|} \text{ for some } a > 0$$

Find its FT $X(j\omega)$

Ans:

Example: $X(j\omega) = e^{-b|\omega|}$ for some $b > 0$. Find $x(t)$

Ans:

* The formulas:

$$\int x(t) =$$

$$X(jw) =$$

* The two formulas are VERY SIMILAR but not identical. This is good in the sense that many computation can be reused. But this is also bad in the sense that it is very confusing for the first-time users.

* A side note: You might have noticed that we have seen this formula before

CT periodic

$$x(t) \xrightarrow{\quad * h(t) \quad} y(t)$$

F.S. $\downarrow$ $\qquad \downarrow$ $\qquad$ F.S.

$$a_k, w_0 \qquad H(jw) \qquad b_k = a_k \cdot H(jkw_0)$$

$$w_0$$
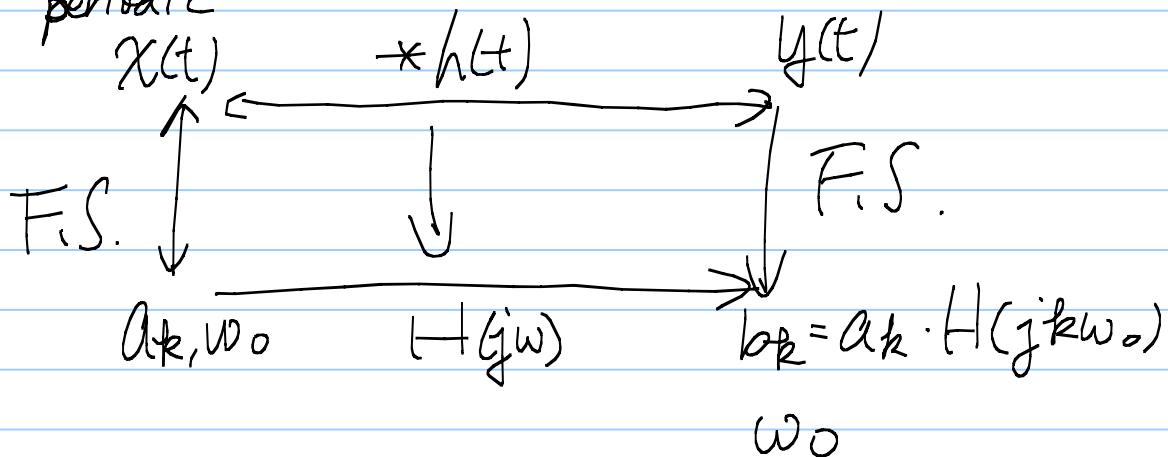
We term $H(jw)$, the [_____]
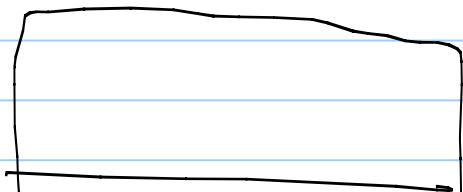
* The freq response $H(jw)$ is the [_____] of the impulse response $h(t)$.