

* Watch Video 3,6

P.096

* DT Fourier series representation

Subject :

Representation :

Given N

Synthesis formula

Analysis formula

* Two methods of finding a_k : ① Inspection & ② direct computation.

* An easy way to remember is

$$\begin{array}{ccccccc} a_{-N} & a_{-N+1} & \dots & \dots & a_{-1} \\ \rightarrow & a_0 & a_1 & a_2 & \dots & a_{N-1} \\ & a_N, & a_{N+1}, & \dots & a_{2N-1} \end{array}$$

* Properties of DT FS

Selected properties (See Table 3.2 p. 221 for a detailed list of properties)

1. Linearity

$$x[n] \xleftrightarrow{\text{F.S.}} a_k, \frac{2\pi}{N}$$

$$y[n] \xleftrightarrow{\text{F.S.}} b_k, \frac{2\pi}{N}$$

$$z[n] = Ax[n] + By[n]$$

$$\xleftrightarrow{\text{F.S.}}$$

Write down your own comparison to CT, FS.

2. Time-Shift

$$x[n] \xleftrightarrow{\quad} a_k, \frac{2\pi}{N}$$

$$y[n] = x[n - n_0]$$

$$\xleftrightarrow{\quad}$$

Comparison to CTFS

3. Time-Reversal

$$x[n] \xleftrightarrow{\text{FS}} a_k, \frac{2\pi}{N}$$

$$y[n] = x[-n] \xleftrightarrow{\text{FS}}$$

$$\left| \begin{array}{cccccc} a_{-N} & a_{-N+1} & \dots & \dots & a_{-1} & \\ a_0 & a_1 & a_2 & \dots & a_{N-1} & \\ a_N, a_{N+1}, & \dots & & & a_{2N-1} & \end{array} \right.$$

So we often write

4 Multiplication

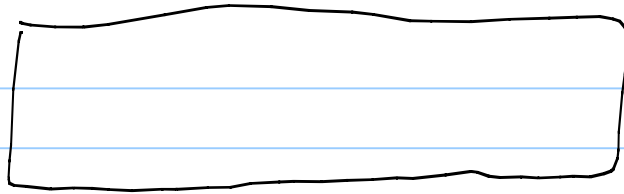
$$x[n] \xleftrightarrow{\text{FS}} a_k, \frac{2\pi}{N}$$

$$y[n] \xleftrightarrow{\text{FS}} b_k, \frac{2\pi}{N}$$

$$z[n] = x[n] \cdot y[n] \xleftrightarrow{\text{FS}}$$

Comparison to CTFS.

Ans:

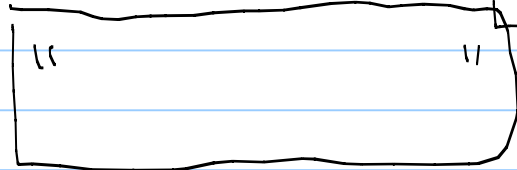


Similar to

the convolution sum, but is different
as the summation is not over



We term it the



convolution.

Example: Given $N=5$ &

$$x[n] \xleftrightarrow{\text{F.S}} a_0, \dots, a_4, \frac{2\pi}{5}$$

$$y[n] \xleftrightarrow{\text{F.S}} b_0, \dots, b_4, \frac{2\pi}{5}$$

$$z[n] = x[n] \cdot y[n]$$

$$\longleftrightarrow c_0, \dots, c_4, \frac{2\pi}{5}$$

Q: Express c_2 in terms of a & b .

Ans: