

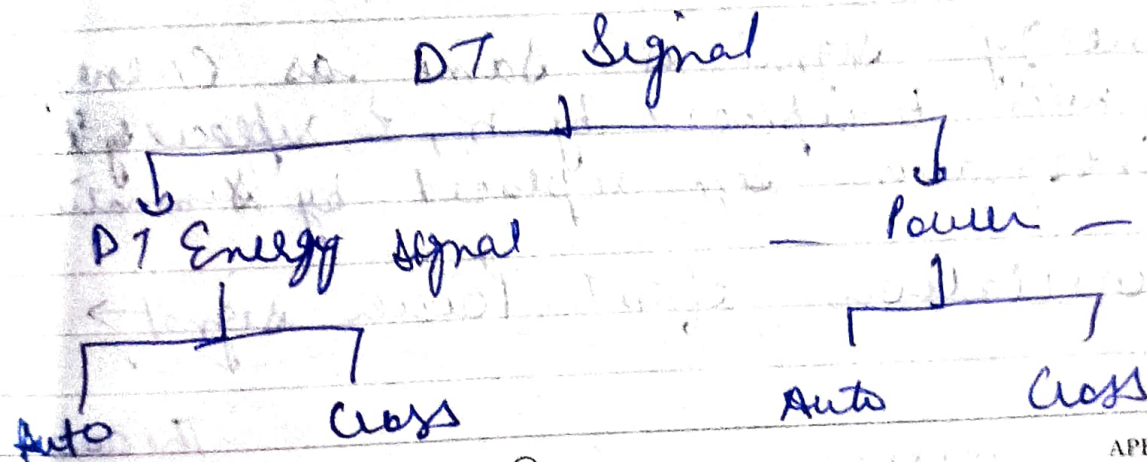
Correlation of Discrete time signals $\rightarrow$

① Autocorrelation

② Cross Correlation

Each of the two types of Correlations are applicable to the two types of DT signals namely

1. DT energy signal
- ② DT power signal



APRIL							2015
Wk	M	T	W	T	F	S	S
14			1	2	3	4	5
15	6	7	8	9	10	11	12
16	13	14	15	16	17	18	19
17	20	21	22	23	24	25	26
18	27	28	29	30			

Autocorrelation of DT Signal $\rightarrow$ The autocorrelation is the measure of similarity b/w a sequence $x(n)$ and its shifted version say $x(n-k)$

Auto correlation of DT Energy signal

$$R(k) = \sum_{n=-\infty}^{\infty} x(n) \cdot x(n-k) \quad \text{--- (1)}$$

$\uparrow$ real signal $\uparrow$ time shifted signal
 time

$$R(k) = \sum_{n=-\infty}^{\infty} x(n) \cdot x(n+k) \quad \text{--- (2)}$$

DT energy signal is same as CT energy signal with t replaced by n , τ replaced by k and integration sign replaced by summation

Auto correlation of DT Power signal $\rightarrow$

The auto correlation fn of a real value discrete time power signal $x(n)$ is defined as

MARCH	2016						
Wk	M	T	W	T	F	S	S
06	30	31				1	
13	2	3	4	5	6	7	8
20	9	10	11	12	13	14	15
27	16	17	18	19	20	21	22
03	23	24	25	26	27	28	29

$$R(k) = \lim_{N \rightarrow \infty} \frac{1}{2N+1} \sum_{n=-N}^N x(n) x(n-k) \quad \text{--- (3)}$$

or

$$R(k) = \lim_{N \rightarrow \infty} \frac{1}{2N+1} \sum_{n=-N}^N x(n) x(n+k) \quad \text{--- (4)}$$

Cross Correlation of DT signal →
 correlation of two DT signal is a measure of similarity b/w them. We will define the cross correlation for energy & power DT signal

CC of DT Energy signal →
 $x_1(n)$ & $x_2(n)$ pair of real values

$$R_{12}(k) = \sum_{n=-\infty}^{\infty} x_1(n) \cdot x_2(n-k) \quad \text{--- (5)}$$

$$R_{21}(k) = \sum_{n=-\infty}^{\infty} x_1(n-k) x_2(n) \quad \text{--- (6)}$$

CC of DT Power signal →

$$R_{12}(k) = \lim_{N \rightarrow \infty} \frac{1}{2N+1} \sum_{n=-N}^N x_1(n) \cdot x_2(n+k) \quad \text{--- (7)}$$

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APRIL 2015						
Wk	M	T	W	T	F	S
14			1	2	3	4
15	6	7	8	9	10	11
16	13	14	15	16	17	18
17	20	21	22	23	24	25
18	27	28	29	30		

$$R_{21}(k) = \lim_{N \rightarrow \infty} \frac{1}{2N+1} \sum_{n=-N}^N x_1(n-k) x_2(n)$$

→ The Cross Correlation fn is generally not ~~con~~ Cumulative

→ The signal $x_1(n)$ & $x_2(n)$ are said to be orthogonal if the cross correlation b/w them is zero

for orthogonal signal $R_{12}(k) = 0$

Positively correlated, -ve correlated and uncorrelated

→ If correlation fn has non zero value for -ve value of k then signal is said to be negatively correlated

→ If non-zero, the value of k is called truly correlation

If correlation fn is zero for all the value of k then signal is called uncorrelated