ASSIGNMENT-3

Properties of Discrete Fourier Transform

NAME|COURSE_NAME LAB_NAME | DATE

Circular Folding Property: -

The sequence x(n) is wrapped around a circle in the counterclockwise direction so that indices n = 0 and n = N overlap. Then $x((-n))_N$ can be viewed as a clockwise wrapping of x(n) around the circle; hence the name circular folding. It is defined by

$$\boxed{x((-n))_N = \begin{cases} x(0), & n = 0 \\ x(N-n), & 1 \le n \le N-1 \end{cases}}$$

Circular Convolution Property: -

The multiplication of two DFT sequences is equivalent to the circular convolution of their sequences in the time domain. i.e.

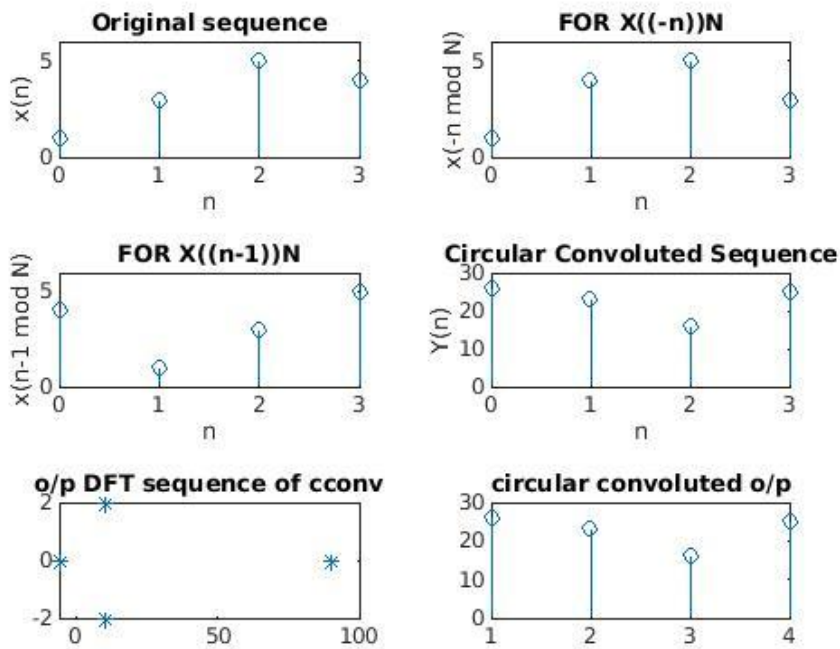
$$x_1(n) \circledN x_2(n) \xrightarrow{DFT} X_1(k).X_2(k)$$

Conclusion: -

If an N-point sequence is folded, then the result x(−n) would not be an N-point sequence, and it would not be possible to compute its DFT. Therefore, we use the modulo-N operation on the argument (−n).The circular convolution property gives as 2 ways to find the circular convolution of the signals i.e. either by time domain method or by frequency domain method.

MATLAB OUTPUT: -

- The plot and equations of the circular convolution and circular folding property of DFT of the various sequences given below



```
>> assgn3_ec243_19010210
Q.1 ->
Original sequence
     1     3     5     4


FOR X((-n))N
     1     4     5     3


FOR X((n-1))N
     4     1     3     5


Q.2 ->
Convoluted Sequence Y(n) is:
    26
    23
    16
    25


1st i/p sequence is
     2     3     4
```

```
1st i/p sequence is
     2     3     4


2nd i/p sequence is
     1     2     3     4


DFT of 1st sequence is
   9.0000 + 0.0000i  -2.0000 - 3.0000i   3.0000 + 0.0000i  -2.0000 + 3.0000i


DFT of 2nd sequence is
  10.0000 + 0.0000i  -2.0000 + 2.0000i  -2.0000 - 0.0000i  -2.0000 - 2.0000i


Dft of o/p sequence is
  90.0000 + 0.0000i  10.0000 + 2.0000i  -6.0000 - 0.0000i  10.0000 - 2.0000i


IDFT of o/p sequence is
  26.0000 + 0.0000i  23.0000 + 0.0000i  16.0000 - 0.0000i  25.0000 - 0.0000i


>>
```