

4. 8-POINT FFT ALGORITHM

AIM:

To implement 8-point FFT algorithm without using matlab inbuilt function.

APPARATUS:

PC with MATLAB

THEORY:

The DFT is the only transform that is discrete in both the time and the frequency domains, and is defined for finite-duration sequences. Although it is a computable transform, the straightforward implementation of it is very inefficient, especially when the sequence length N is large. In 1965 Cooley and Tukey showed a procedure to substantially reduce the amount of computations involved in the DFT. This led to the explosion of applications of the DFT, including in the digital signal processing area. Furthermore, it also led to the development of other efficient algorithms. All these efficient algorithms are collectively known as fast Fourier transform (FFT) algorithms.

Consider an N -point sequence $x(n)$. Its N -point DFT is given by

$$X(k) = \sum_{n=0}^{N-1} x(n)W_N^{nk}, \quad 0 \leq k \leq N-1$$

Where $W_N = \exp(-j*2*\pi)/N$.

The FFT algorithms exploit 2 properties of twiddle factor (W_N) and reduces the number of complex multiplications to perform DFT from N^2 to $(N/2)*\log_2 N$. This implies about 5000 instead of 10^6 multiplications, a reduction factor of 200.

PROCEDURE:-

- Open MATLAB
- Open new M-file
- Type the program
- Save in current directory
- Compile and Run the program
- For the output see command window\ Figure window

PROGRAM:

```
% To implement 8-point FFT algorithm.

clc;
clear all;
close all;
x = input('Enter the N = 8 sequence : ');
N1 = length(x);
```

DIGITAL SIGNAL PROCESSING LAB

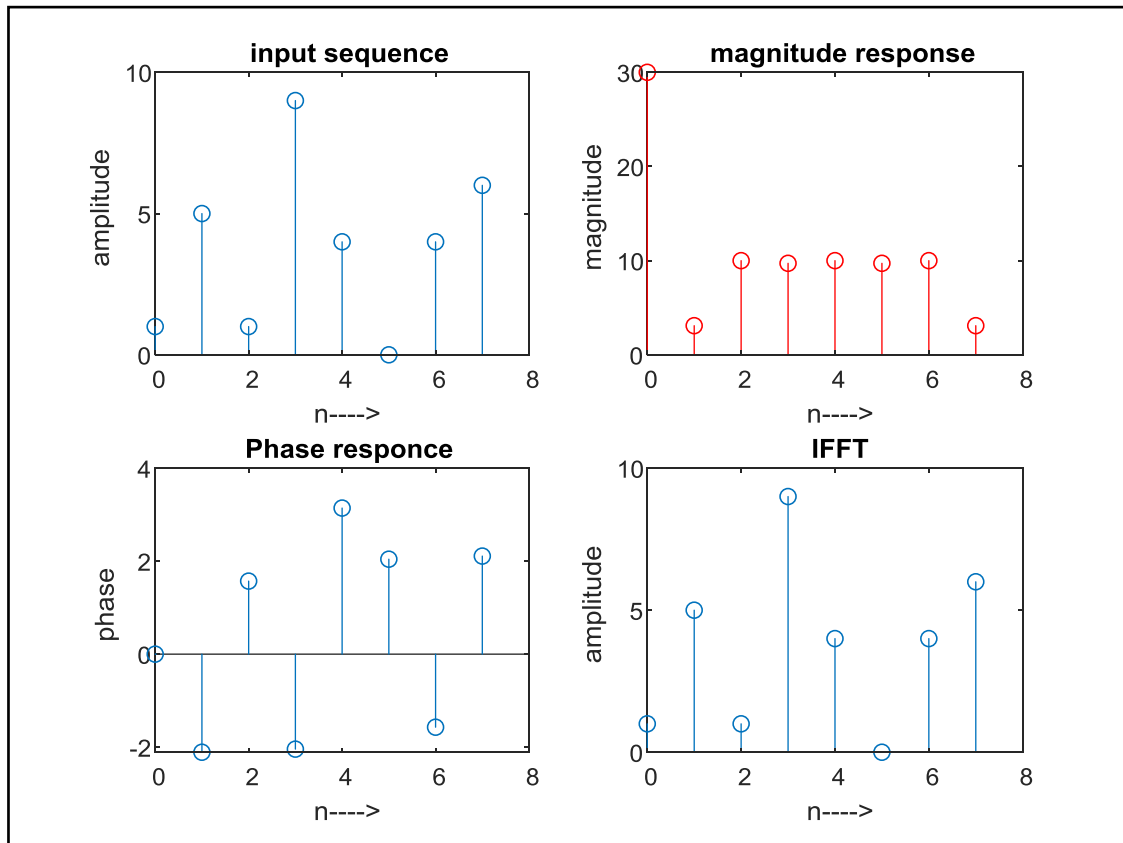
```
xK1 = fft(x,N1);
xn1 = ifft(xK1);
n=0:N1-1;
subplot (2,2,1);
stem(n,x);
xlabel('n---->');
ylabel('amplitude');
title('input sequence');
subplot (2,2,2);
stem(n,abs(xK1),'r');
xlabel('n---->');
ylabel('magnititude');
title('magnititude response');
subplot (2,2,3);
stem(n,angle(xK1));
xlabel('n---->');
ylabel('phase');
title('Phase responce');
subplot (2,2,4);
stem(n,xn1);
xlabel('n---->');
ylabel('amplitude');
title('IFFT');
```

INPUT:

Enter sequence x = [1 5 1 9 4 0 4 6]

OUTPUT:

DIGITAL SIGNAL PROCESSING LAB



RESULT:

For the given 8 point sequence, DFT is obtained using 8 point DIT FFT and the corresponding magnitude and phase of the output are plotted.