**DSP LABWORK**

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**Week 2**: **Realization of DFT using MATLAB**

**Aim:**

To realize Discrete Fourier Transform (DFT) of any Discrete Time Signal.

**Software Used:**

MATLAB R2020

**Pseudo Code:**

1. Make a function for finding the DFT of the signal
2. Iterate n from 0 to N-1
3. Find the sum of x(n)exp(-j\*2\*pi\*k\*n/N) for all values of n
4. Iterate k from 0 to N-1
5. And repeat step (i) and (ii) for each value of k
6. Return the result as X(k)
7. Using the function, find the DFT of the given signal
8. Plot the signal x(n) vs n, abs(X(k)) vs k and angle(X(k)) vs k

**MATLAB script:**

**Functon definition of findDFT():**

function result = findDFT(x)

%This function gets any point sequence as input vector

%and returns its DFT as output vector

N = length(x);

result(1:length(x)) = 0; %it stores the DFT of x

for k=0:N-1 %for iterating differant values of k

temp = 0; %This is where the X(k) will be stored

for n=0:N-1 %for iterating differant values of n for

%the given k

temp = temp + x(n+1)\*power(twiddleFactor(N),k\*n);

end

result(k+1) = temp;

end

end

function result = twiddleFactor(N)

%This function returns the twiddle factor/ basis function / N th root of

%unity

result = exp((-j\*2\*pi)/N);

end

**The actual script:**

clc

clear variables

xn = [1, 2, 3, 4]; %Feel free to change xn to any point sequence

xnZero(1:5) = 0; %5 is the 0 padding for x[n]

%This time samples for x(n)

n = [-(length(xnZero)+length(xn)):length(xnZero)+length(xn)-1];

%These is x(n) formatted for plotting

xnForPlot = [xnZero, xn\*0, xn, xnZero];

subplot(2,2,1);

stem(n,xnForPlot);xlabel("n");ylabel("x[n]");

%This is k for X(k)

k = n;

%X(k) evaluated from findDFT function defined in the same directory

xnDFT = findDFT(xn);

%X(k) formotted for plotting

xnDFTForPlot = [xnZero, xnDFT\*0, xnDFT, xnZero];

subplot(2,2,3);

stem(k,real(xnDFTForPlot));xlabel("k");ylabel("magnitude(X(k))");

subplot(2,2,4);

stem(k,imag(xnDFTForPlot));xlabel("k");ylabel("phase(X(k))");

sgtitle("Realization of DFT");

**Result:**

Test signal is x(n) = {1, 2, 3, 4}

