Experiment No: 5 Date: 10/09/24

Linear Convolution using Circular Convolution and Vice versa.

Aim:

1. To perform Linear Convolution using Circular Convolution. 2. To perform Circular Convolution using Linear Convolution.

Theory:

Performing Linear Convolution Using Circular Convolution Method:

1. **Zero-Padding:**
   - Pad both sequences x[n] and h[n] with zeros to a length of at least 2N-1, where N is the maximum length of the two sequences. This ensures that the circular convolution will not wrap around and introduce artificial periodicity.
2. **Circular Convolution:**
   - Perform circular convolution on the zero-padded sequences.
3. **Truncation:**
   - Truncate the result of the circular convolution to the length N1 + N2 - 1, where N1 and N2 are the lengths of the original sequences x[n] and h[n], respectively.

Example:

Consider the sequences x[n] = [1, 2, 3] and h[n] = [4, 5].

1. Zero-padding:
   - Pad x[n] to [1, 2, 3, 0, 0] and h[n] to [4, 5, 0, 0].

2. Circular Convolution:
    - Perform circular convolution on the zero-padded sequences. The result will be [4, 13, 21, 15, 0].
3. Truncation:
    - Truncate the result to [4, 13, 21, 15].

This result is the same as the linear convolution of x[n] and h[n].

Performing Circular Convolution Using Linear Convolution

Method:

1. **Zero-Padding:**
    - Pad both sequences x[n] and h[n] to a length of at least 2N-1, where N is the maximum length of the two sequences.
2. **Linear Convolution:**
    - Perform linear convolution on the zero-padded sequences.
3. **Modulus Operation:**
    - Apply the modulus operation to the indices of the linear convolution result, using the period N. This effectively wraps around the ends of the sequence, making it circular.

Example:

Using the same sequences as before, x[n] = [1, 2, 3] and h[n] = [4, 5].

1. Zero-padding:
    - Pad x[n] to [1, 2, 3, 0, 0] and h[n] to [4, 5, 0, 0].
2. Linear Convolution:
    - Perform linear convolution. The result will be [4, 13, 21, 15, 0].
3. Modulus Operation:
    - Apply the modulus operation to the indices: [4, 13, 21, 15, 0] becomes [4, 13, 2, 15, 0].

Program:

1. Linear Convolution using Circular Convolution

```
clc; clear all; close all; x = [1 2 3
4]; h = [1 1 1 ]; l = length(x); m =
length(h); k = l+m-1; x = [x zeros(1,k-
l)]; h = [h zeros(1,k-m)];
X_k = fft(x);
H_k = fft(h); Y_k = X_k.*H_k; y = ifft(Y_k);
disp("Linear Convolution using Circular Convolution :");
disp(y);
```

2.Circular convolution using Linear Convolution

```
clc; close all; clear all; x = [1 2 3
4]; h = [1 1 1 ]; l = length(x); m =
length(h); lc = max(l,m); ll= l+m-1; y
= conv(x,h); for i=1:ll-lc y(i) = y(i)
+ y(lc+i); end for i=1:lc y1(i) = y(i);
end
disp("Circular convolution using Linear Convolution:")
disp(y1);
```

Result:

Performed a) Linear Convolution using Circular Convolution; b) Circular Convolution using Linear Convolution and verified result.

Observation:

1.Linear Convolution using Circular Convolution:

Linear Convolution using Circular Convolution:

1 3 6 9 7 4

2.Circular convolution using Linear Convolution:

Circular convolution using Linear Convolution:

8 7 6 9

Experiment No: 6 Date: 01/10/24

DFT AND IDFT

Aim:

1.DFT using inbuilt function and without using inbuilt function. Also plot magnitude and phase plot of DFT