

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 $N_1 + N_2 - 1$, where N_1 and N_2 are the lengths of the original sequences $x[n]$ and $h[n]$, respectively.

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.

Program

a)Linear convolution using circular convolution

```
clc;
clear all;
close all;
x=[1 2 3 4];
h=[1 1 1];
n=length(x)+length(h)-1;
x=[x zeros(1,n-length(x))];
h=[h zeros(1,n-length(h))];
x1=fft(x);
h1=fft(h);
y1=x1.*h1;
y=ifft(y1);
disp("Linear Convolution using Circular Convolution :");
disp(y);
```

b)Circular convolution using linear convolution

```
clc;
clear all;
close all;
x=[1 2 3 4];
h=[1 1 1];
y=conv(x,h);
conv_len=max(length(x),length(h));
result=[y(1:conv_len)];
new_arr=[y(conv_len+1:length(y)) zeros(1,length(y)-conv_len)];
```

```
result=result+new_arr;
```

```
disp("Circular convolution using Linear Convolution:")
```

```
disp(result);
```

Result

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

Observation

a)Linear convolution using circular convolution

Linear Convolution using Circular Convolution:

1 3 6 9 7 4

b)Circular convolution using linear convolution

Circular convolution using Linear Convolution:

8 7 6 9