Experiment No: 03 Date: 08-08-2024

Linear Convolution

Aim

To find linear convolution of two input sequences ,

a) with built in function.
b) Without built in function.

Theory

Linear convolution is a mathematical operation used to combine two signals to produce a third signal. It's a fundamental operation in signal processing and systems theory.

Mathematical Definition:

Given two signals, x(t) and h(t), their linear convolution is defined as:

$$y(t) = x(t) * h(t) = \int_{-\infty}^{\infty} x(\tau)h(t-\tau)\,d\tau$$

Applications:

Filtering: Convolution is used to filter signals, removing unwanted frequencies or noise.

System Analysis: The impulse response of a system completely characterizes its behaviour, and convolution can be used to determine the output of the system given a known input.

Image Processing: Convolution is used for tasks like edge detection, blurring, and sharpening images.

Program

a)with built in function

```
clc;
clear all;
close all;
x=input("Enter the elements in x[n]:");
x_ind=input("Enter the index of x[n]:");
h=input("Enter the elements in h[n]:");
h_ind=input("Enter the index of h[n]:");
y=conv(x,h);
y_ind=min(x_ind)+min(h_ind):max(x_ind)+max(h_ind);
```

```
disp('Linear convolution result:');
disp(y);
stem(y_ind,y);
title("Linear convolution");
xlabel("time index");
ylabel("amplitude");
```

b)without built in function

```
clc;
clear all;
close all;
x=input("Enter the elements in x[n]:");
x_ind=input("Enter the index of x[n]:");
h=input("Enter the elements in h[n]:");
h_ind=input("Enter the index of h[n]:");
n1 = length(x);
n2 = length(h);
n = n1 + n2 - 1;
y = zeros(1, n);
for i = 0:n-1
    for j = 0:n1-1
        if (i - j >= 0 && i - j < n2)
            y(i+1) = y(i+1) + x(j+1) * h(i - j + 1);
        end
    end
end
disp('Linear convolution result:');
disp(y);
y_ind=min(x_ind)+min(h_ind):max(x_ind)+max(h_ind);
stem(y_ind,y);
```

```
title("Linear convolution");
xlabel("time index");
ylabel("amplitude");
```

Result

Performed Linear Convolution using with and without built-in function**.**

Observation

a)with built in function

INPUT:

Enter the elements in x[n]:

[1 2 1 1]

Enter the index of x[n]:

0:3

Enter the elements in h[n]:

[1 1 1 1]

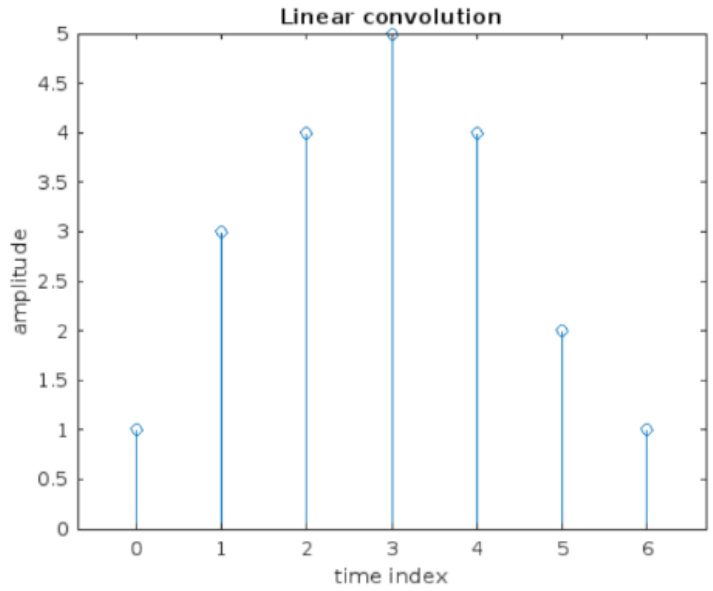
Enter the index of h[n]:

0:3

OUTPUT:

Linear convolution result:

1 3 4 5 4 2 1



b)without built in function

INPUT:

Enter the elements in x[n]:

[1 2 1 1]

Enter the index of x[n]:

0:3

Enter the elements in h[n]:

[1 1 1 1]

Enter the index of h[n]:

0:3

OUTPUT:

Linear convolution result:

1 3 4 5 4 2 1