Heaven's Light is Our Guide

Rajshahi University of Engineering& Technology

Department of Electrical & Computer Engineering

Course No: ECE 4124
Course Name: Digital Signal Processing Sessional

Submitted by:
Name: Nafia Islam Shishir
Roll: 1810033

Submitted to:
Hafsa Binte Kibria
Lecturer,
Dept. of ECE
RUET

Experiment No: 02

Experiment Date: 30.04.2023

Experiment Name: Calculation and representation of linear convolution using MATLAB.

Theory: Convolution is a mathematical operation that combines two signals to produce a third signal. It can be seen as a way of applying a filter or a system to an input signal to get an output signal. It is used in many applications in digital world, such as- digital filter, data compressor, biomedical signal processing, speech and image processing etc.

Linear convolution is a mathematical operation done to calculate the output of any Linear-Time Invariant (LTI) system given its input and impulse response. It is applicable for both continuous and discrete-time signals.

We can represent Linear Convolution as-

y(n)=x(n)*h(n)

Here, y(n) is the output (also known as convolution sum). x(n) is the input signal, and h(n) is the impulse response of the LTI system.

In linear convolution, both the sequences (input and impulse response) may or may not be of equal sizes. That is, they may or may not have the same number of samples. Thus, the output, too, may or may not have the same number of samples as any of the inputs.

Software used: MATLAB

Code:

```
clc;
clear all;
close all;

x=[1 3 2 4];
h=[4 2 3 2];

C=x.'*h;

k=length(x);
l=length(h);
n=k+l-1;

for i=1:n
    y(i)=0;
    for j=1:k
        s=i-j;
        m=i-j+1;
        if(s<k && m>0)
            y(i)=y(i)+C(m,j);
        end
    end
end
```

```
24. fprintf('The convoluted values:');
25. display(y);
26.
27. subplot(3,1,1);
28. stem(x);
29. title('The input Signal x(n)');
30. subplot(3,1,2);
31. stem(h);
32. title('The Impulse Signal h(n)');
33. subplot(3,1,3);
34. stem(y);
35. title('The Convoluted Sum y(n)');
```

Output:

```
Command Window
The convoluted values:
y =
     4     14     17     31     20     16      8
```

Fig. 1 Convoluted values of y(n)

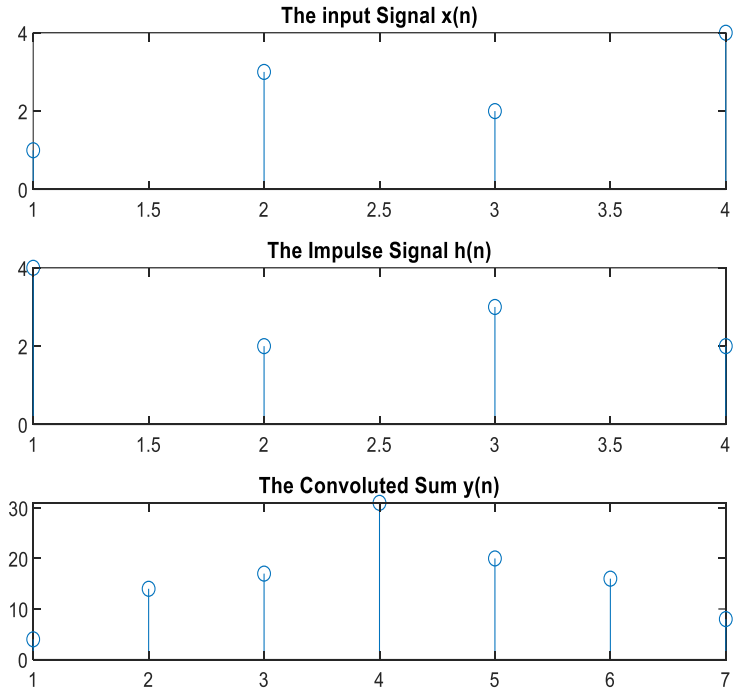

Fig. 2 Linear Convoluted plot

Discussion: In the experiment, we have worked with the linear convolution of signals using the matrix multiplication of input signal with impulse response and summing the elements diagonally. Then, we plotted the results using MATLAB.

Conclusion: All the code and plots run successfully in the experiment without any type of error or complexities.