Heaven's Light is Our Guide

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

LAB REPORT

Course No: EEE 4108

Course Name: Digital signal processing Sessional

Experiment No: 04

Experiment Name: Study of convolution of the given signals using MATLAB code

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Experiment No: 04

4.1 Experiment Name:

Study of convolution of the given signals using MATLAB code

4.2 Objectives:

1. To get introduced to convolution

2. To know about convolution by using MATLAB code

4.3 Theory:

Convolution is a fundamental mathematical operation used in various fields, including mathematics, engineering, physics, signal processing, and image processing. It involves combining two functions to produce a third function that represents how one of the original functions "influences" the other as they overlap and merge. The result of the convolution operation is often referred to as the "convolution product" or simply "convolution."

The convolution operation is denoted using the asterisk symbol (*). If we have two functions, f(x) and g(x), their convolution is represented as (f * g)(x). The convolution of two functions is defined as follows:

(f * g)(x) = ∫[from -∞ to ∞] f(t) * g(x - t) dt

In this equation:

(f * g)(x) is the convolution of functions f and g evaluated at point x.

f(t) and g(t) are the two functions being convolved.

(x - t) represents the overlapping between the two functions as they slide relative to each other.

dt denotes the differential element used in integration.

The convolution operation is commutative, meaning the order of the functions does not affect the result:

(f * g)(x) = (g * f)(x)

4.4 Code for Convolution:

```
clc
clear all
x = [-1 2 0 1]; % define the first sequence
h = [3 1 0 -1]; % define the second sequence
n1 = -1:1:2; % define the time interval for x
n2 = -2:1:1; % define the time interval for h
% Plotiing x(n)
subplot(2,2,1)
stem(n1,x)
xlim([min(n1)-1 max(n1)+1]);%xlim and ylim set the appropriate limits for the axes.
ylim([min(x)-1 max(x)+1]);
title('x(n)');
xlabel('Time')
```

```
ylabel('Amplitude')
% Plotiing h(n)
subplot(2,2,2)
stem(n2,h)
xlim([min(n2)-1 max(n2)+1]);
ylim([min(h)-1 max(h)+1]);
title('h(n)');
xlabel('Time')
ylabel('Amplitude')
% Creating Matrix
mat=[];
for i=1:length(x)
    ss=h.*x(i);
    mat=[mat;ss];
end

% Summation of the Values
[r c]=size(mat);
lim = r+c;
t=2;
y=[];
s=0;
while (t<=lim)
    for i=1:r
        for j=1:c
            if ((i+j)==t)
                s=s+mat(i,j);
            end
        end
    end
    t=t+1;
    y=[y s];
    s=0;
end

% Printing & Plotting
y;
n3=min(n1)+min(n2);
n4=max(n1)+max(n2);
n5=n3:n4;
subplot(2,2,3)
stem(n5,y)
xlim([n3-1 n4+1]);
ylim([min(y)-1 max(y)+1]);
title('convoultion');
xlabel('Time')
ylabel('Amplitude')
```

4.5 Output waveform for Convolution:

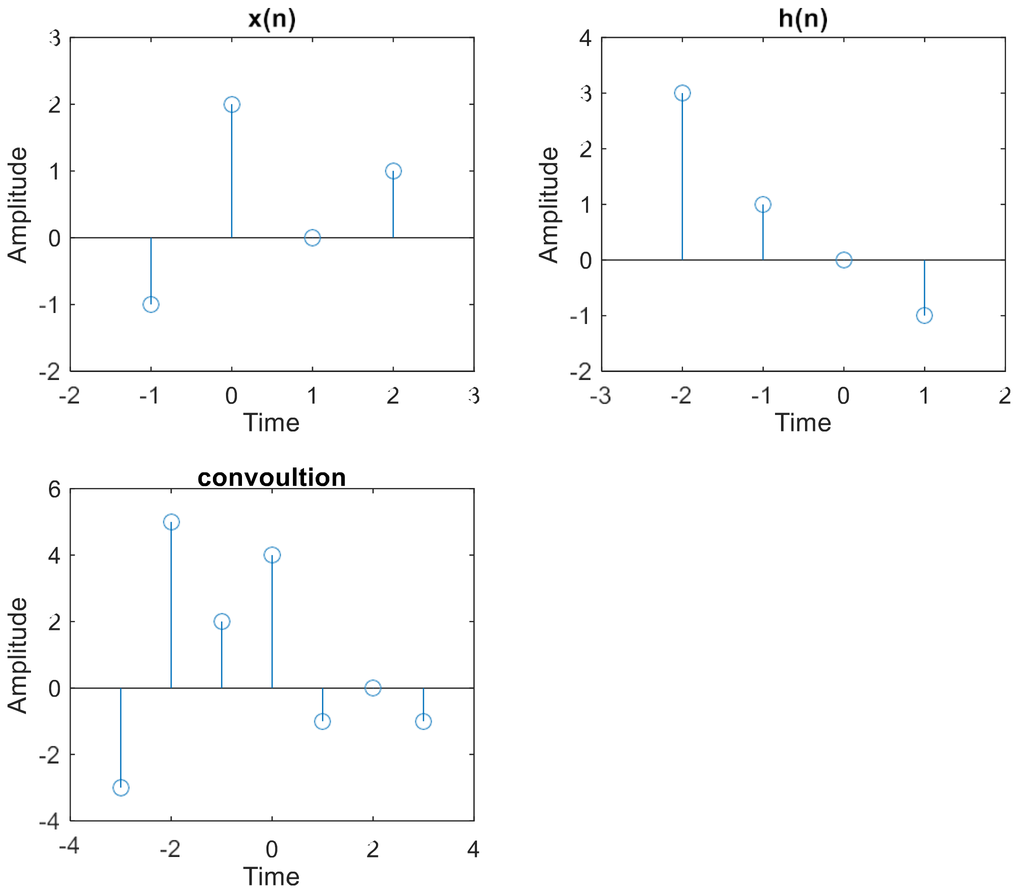

Fig.4.1. Convolution output waveform

4.6 Discussion and Conclusion:

Convolutions are indispensable tools for analyzing signals and data in diverse domains. They help in understanding the patterns, relationships, and time delays present within signals. In this experiment Convolution graph plot and compare each other. Therefore, the experiment was successfully done.