Heaven's Light is Our Guide

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Electrical & Computer Engineering

Digital Signal Processing Sessional

LAB REPORT

Number of Experiment: 01

Course Title: **Digital Signal Processing Sessional**

Course No: ECE 4124

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Submitted by: *Submitted to:*

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1.1 Experiment No: 01
1.2 Experiment Date: March 19, 2023
1.3 Experiment Name: Study of linear convolution and implementation using MATLAB
1.4 Theory:

Convolution is a mathematical tool for combining two signals to produce a third signal. In other words, the convolution can be defined as a mathematical operation that is used to express the relation between input and output of an LTI (Linear Time Invariant) system.

Consider two signals x(n) and h(n) Then, the convolution of these two signals is defined as-

$$y(n) = \sum_{k=-\infty}^{\infty} x(k) * h(k)$$

1.5 Used Platform: MATLAB
1.6 Code:

```matlab
clc;
clear all;
close all;

xn = [ 1, 2, 3, 4];
hn = [4, 4, 3, 2];

l1 = length(xn);
l2 = length(hn);

m = l1+l2-1;
z = zeros(1, m);

z = conv(xn, hn);
display('Result of convolution using conv() function');
display(z);

xn1 = [xn,zeros(1, l2-1)];
hn1 = [hn,zeros(1, l1-1)];
z1 = zeros(1, m);

for i = 1:m
    for j= 1:i
        z1(i) = z1(i)+xn1(j)*hn1(i-j+1);
    end
end
display('Result of convolution without using conv() function');
display(z1);

%Ploting


subplot(3,1,1);
stem(xn);
title("x(n)");


subplot(3,1,2);
```

```
stem(hn);
title("h(n)");


subplot(3,1,3);
stem(z);
title("y(n)");
```

1.7 Output:

```
Result of convolution using conv() function

z =

     4    12    23    36    29    18     8

Result of convolution without using conv() function

z1 =

     4    12    23    36    29    18     8
```

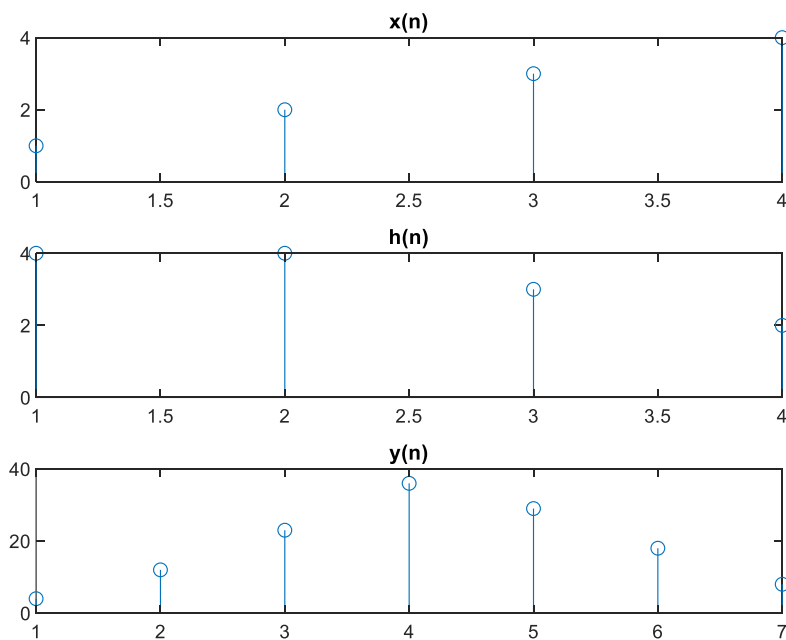*Figure 1.1: Output of convolution with and without using conv() function*

Figure 1.2: Graphical representation of the output of convolution with and without using conv() function

1.8 Discussion:

The experiment was about to implement convolution in MATLB without using built in conv() function. It was implemented successfully using some for loop and mathematical logic. Some matters needed to be handled carefully as array index in MATLAB starts from 1 instead of 0. So, all the indexes of x(n) and y(n) was incremented by 1.

1.9 Conclusion:

The code was implemented successfully. The output of the code was similar to the theory.