

Heaven's Light is Our Guide

Rajshahi University of Engineering & Technology



Department of Electrical & Computer Engineering

Course No: ECE 4124

Course Title: Digital Signal Processing Sessional

Experiment No: 01

Experiment Name: Convolution of Two Signals

Submitted by:

Name: Md. Zayed Al Masud

Roll: 1810016

Date of Experiment: 19. 03. 2023

Date of Submission: 03. 05. 2023

Submitted to:

Hafsa Binte Kibria

Lecturer,

Dept. of ECE

Theory:

Convolution is a mathematical way of combining two signals to form a third signal. It is an important technique in Digital Signal Processing. Convolution is a formal mathematical operation, just as multiplication, addition, and integration. Addition takes two numbers and produces a third number, while convolution takes two signals and produces a third signal.

The convolution of two signals $x(n)$ and $h(n)$ is given by,

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

Or,

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

Convolution satisfies,

- (i) Commutative Law: $h(n) * x(n) = x(n) * h(n)$,
- (ii) Associative Law: $[x(n) * h(n)] * h_1(n) = x(n) * [h(n) * h_1(n)]$ and
- (iii) Distributive Law: $x(n) * [h(n) + h_2(n)] = x(n) * h(n) + x(n) * h_2(n)$

Code:

```
x = [1, 2, 3, 4];
h = [4, 4, 3, 2];
L = length(x);
M = length(h);
N = L + M - 1;
cv = zeros(1,N);
x1 = [x, zeros(1,L)];
h1 = [h, zeros(1,M)];
for i = 1:N
    for j = 1:M
        if (i-j+1) > 0
            cv(i) = cv(i) + x1(j)*h1(i-j+1);
        end
    end
end
disp(cv)
subplot(3,1,1); stem(x); xlabel('n');
ylabel('x[n]'); title('First Signal');

subplot(3,1,2); stem(h); xlabel('n');
ylabel('h[n]'); title('Second Signal');

subplot(3,1,3); stem(cv); xlabel('n');
ylabel('Y[n]'); title('Convolutud Signal');
```

Output:

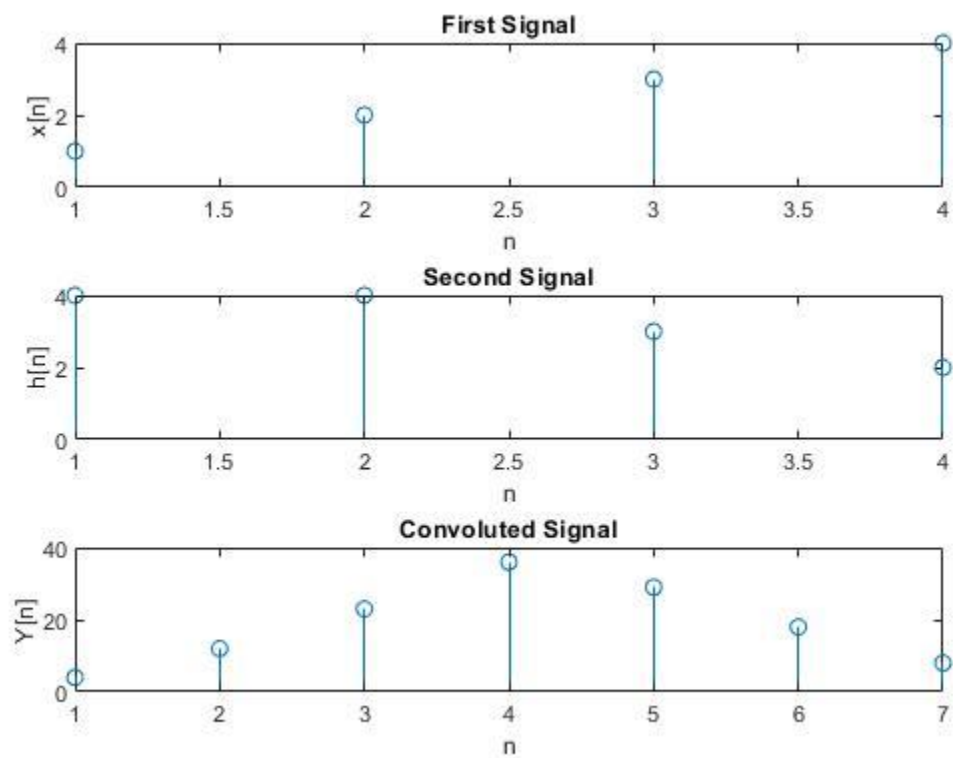


Fig 1.1: Convolution of Two Signals

Conclusion:

In this experiment, convolution was implemented without using any built-in function and the result was plotted.