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

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Experiment No: 01

Experiment Date: 19.03.2023

Experiment Name: Study of convolution of two signals using MATLAB.

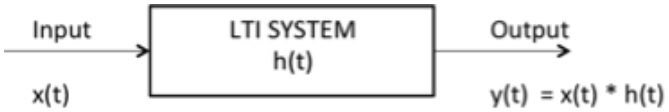
Theory:

Convolution is a mathematical tool to combining two signals to form a third signal. Therefore, in signals and systems, the convolution is very important because it relates the input signal and the impulse response of the system to produce the output signal from the system. In other words, the convolution is used to express the input and output relationship of an LTI system. So, given two functions x(n) and h(n), the convolution of the two is expressed and given by the following mathematical expression:

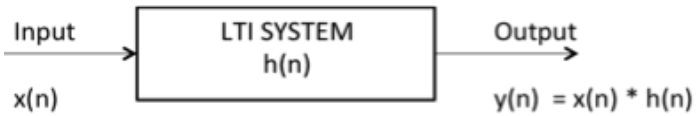
$$y(n) = \sum x(n)*h(n-k) \qquad \text{for } k = -\infty \text{ to } +\infty$$

There are two types of convolutions:

- Continuous convolution: Continuous convolution is used to describe the convolution of two continuous-time signal. It is defined as follows:
  Given two continuous-time signal x(t) and h(t), their continuous convolution y(t) is given by:
  $$y(t) = x(t) * h(t)$$



- Discrete convolution: Discrete convolution, on the other hand, is used to describe the convolution of two discrete-time signal. It is defined as follows:
  $$y(n) = x(n) * h(n)$$

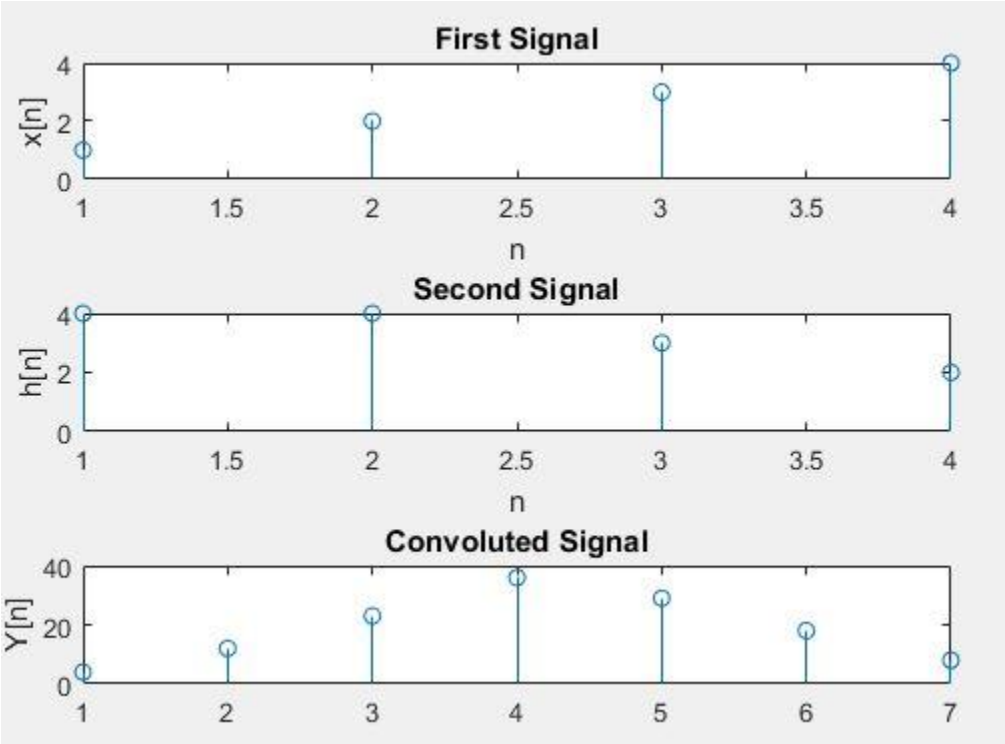


Here, the LTI system refers that a system for which the principle of superposition and the principle of homogeneity are valid and the input/output characteristics do not with time is called the linear time invariant (LTI) system.

Code:

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

h = [ 4 4 3 2];

m=length(x);
l=length(h);
X=[x,zeros(1,l)];
H=[h,zeros(1,m)];

z=[];
for i=1:m
    g=h.*x(i);
    z=[z;g];
end

[r c] = size(z);
k = r+c;
t =2;
Y =[];
cd =0;

while(t<=k)
    for i=1:r
        for j=1:c
            if((i+j)==t)
                cd = cd+ z(i,j);
            end
        end
    end
    t = t+1;
    Y = [Y cd];
    cd =0;
end


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(Y); xlabel('n');
ylabel('Y[n]'); title('Convoluted Signal');
```

Output:



Discussion & Conclusion:

Here, we had convolute same signals without using the conv() function. After that we had used conv() function to check the previous output whether it was similar or not. And here it should be noted that we had got the same result in both of cases.