

Date: 15/10/2025

Experiment No: 05

Experiment Name: Performing convolution of discrete time signals in MATLAB.

Theory:

Convolution is an important operation in Digital Signal Processing (DSP) used to find the output of a Linear Time-Invariant (LTI) system when the input and impulse response are known. It helps describe how systems like digital filters behave.

In this experiment, we perform discrete-time convolution using MATLAB to verify the theory. MATLAB provides a simple function `conv()` to calculate convolution between two signals directly.

The convolution process can be understood in four basic steps:

1. Flip the impulse response $h[k]$ to get $h[-k]$.
2. Shift it by n units to form $h[n-k]$.
3. Multiply overlapping samples of $x[k]$ and $h[n-k]$.
4. Sum all these products to get one output value $y[n]$.

Repeating these steps for all n gives the full output signal.

Codes:

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

```
x = [2, 3, -1, -4, 5, 7, -6];  
n1 = -2 : 4;
```

```
h = [1, 2, 3, 4, 6];  
n2 = -2 : 2;
```

```
y = conv(x, h);  
y_n = n1(1) + n2(1) : n1(end) + n2(end);
```

```
subplot(3, 1, 1);  
stem(n1, x, 'b', 'lineWidth', 1.5);  
title('Input Signal x(n):');  
xlim([-3, 5]);  
ylim([-10, 10]);
```

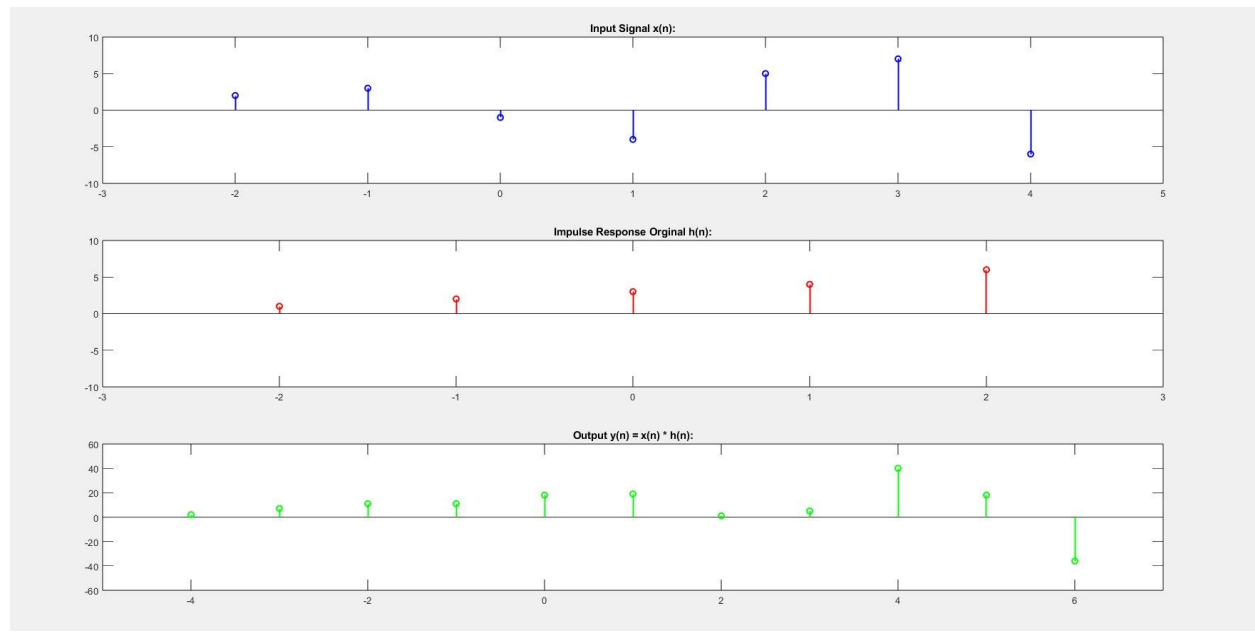
```
subplot(3, 1, 2);  
stem(n2, h, 'red', 'lineWidth', 1.5);  
title('Impulse Response Orginal h(n):');  
xlim([-3, 3]);  
ylim([-10, 10]);
```

```

subplot(3, 1, 3);
stem(y_n, y, 'g', 'lineWidth', 1.5);
title('Output y(n) = x(n) * h(n):');
xlim([-5,7]);
ylim([-60, 60]);

```

Output:



Discussion:

This MATLAB program performs the discrete-time convolution of two finite-length signals and displays the results graphically. The input signal $x[n] = [2, 3, -1, -4, 5, 7, -6]$ and the impulse response $h[n] = [1, 2, 3, 4, 6]$ are defined with their respective time indices. The convolution operation $y[n] = x[n] * h[n]$ is computed using MATLAB's built-in `conv()` function. The program then uses `subplot()` and `stem()` commands to plot the input, impulse response, and output signals. Each graph is properly labeled and scaled to clearly show the relationship between the signals and the effect of convolution.

Conclusion:

This experiment demonstrated discrete-time convolution using MATLAB. The results confirmed how the input signal and impulse response combine to produce the system output. It clearly showed the importance of convolution in understanding and analyzing digital systems.