Experiment No: 3 Date: 19/08/2024

LINEAR CONVOLUTION

Aim

To perform Linear Convolution using

1. Built-in function
2. Under defined Function

Theory

Linear convolution is a fundamental operation in digital signal processing (DSP) used to analyze the relationship between input signals and systems. It combines two signals to produce a third signal, which represents the output of a system when an input signal is applied.

Linear convolution is a fundamental operation in digital signal processing (DSP) that combines two discrete-time signals to produce a new signal representing the output of a system in response to an input. This process allows us to analyze how an input signal is transformed by the system's characteristics, often described by its impulse response.

The operation involves sliding the impulse response across the input signal and calculating the output at each position, considering the overlapping portions. One of the key features of linear convolution is its order independence; the result remains unchanged regardless of the order in which the signals are combined. This property, along with its associativity and distributivity, makes convolution a versatile tool in signal analysis.

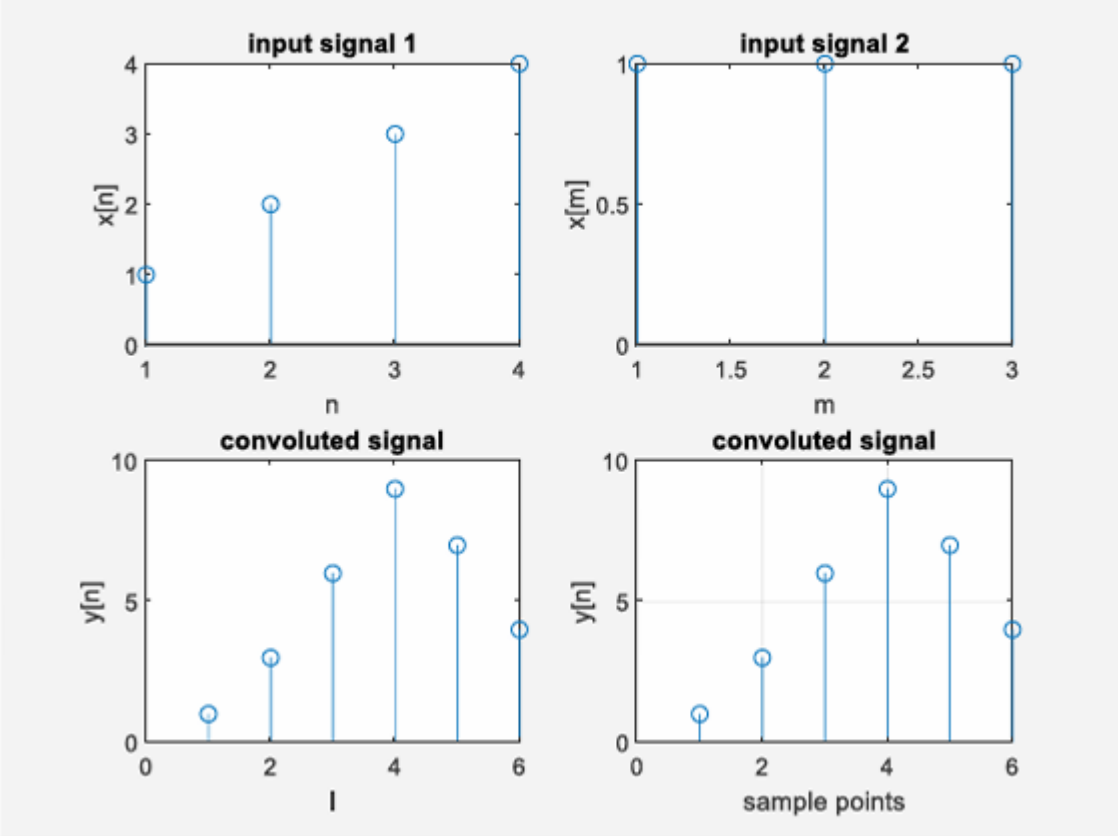
Linear convolution finds wide applications, particularly in filtering, where it is used to modify signals by enhancing or reducing certain characteristics. It is also crucial in system analysis and various image processing tasks, such as blurring and edge detection. While conceptually straightforward, linear convolution can be computationally intensive, often leading to the use of efficient algorithms like the Fast Fourier Transform (FFT) to improve processing speed. Overall, linear convolution is essential for understanding and manipulating signals in diverse applications.

OBSERVATION

INPUT=

Length of 1st signal=4
Length of 2nd signal=3
Input amplitude = [1 2 3 1]
Input amplitude = [1 1 1]

OUTPUT=



Program

```
clc;
clf;
close all;
clear all;
n=input ('Enter the length of the 1st signal=');
m=input ('Enter the length of the 2nd signal=');
sp1=1:1:n;
sp2=1:1:m;
x_n=input ('Input amp of first=');
x_m=input ('Input amp of second=');
l=n+m-1
sp3=1:1:l
y_n=zeros(1,l);
for(n=1:n)
for(k=1:m)
y_n(n+k-1)=y_n(n+k-1)+x_n(n)*x_m(k);
end
end
subplot(221)
stem(sp1,x_n);
xlabel('n');
ylabel('x[n]');
title('input signal 1');
subplot(222)
stem(sp2,x_m);
xlabel('m');
ylabel('x[m]');
title('input signal 2');
subplot(223)
stem(sp3,y_n);
xlabel('l');
ylabel('y[n]');
title('convoluted signal');
subplot(224)
stem(sp3,y_n);
xlabel('sample points');
ylabel('y[n]');
title('convoluted signal');
grid on;
```

Result

Performed Linear Convolution and generated the output