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

Submitted By:	**Submitted To:**
Name: Md. Fahim Shariar **Roll:** 1810002 **Date of Experiment:** 03/05/2023 **Date of Submission:** 08/05/2023	Hafsa Binte Kibria Lecturer, Dept. of ECE RUET

Experiment No: 02

Experiment Date: 03.05.2023

Experiment Name:

i) Take two signals and show the circular convolution of the signals.

ii) If n1 = {0, 0, 0, 2, 2, 2, 1, 1, 1, 0, 2} and n2 = {2, 2, 0, 1, 1, 1, 0, 0, 0, 0, 3}, then plot the figure of two signals and also plot the summation and subtraction of the two signals.

iii) Draw the signals in one figure:

Theory:

Circular convolution is a special case of periodic convolution, which is the convolution of two periodic functions that have the same period. It is also known as cyclic convolution. The Circular Convolution can be performed using two methods: concentric circle method and matrix multiplication method.

In case of "Concentric Circle Method", we firstly assume two finite length sequences $x_1(n)$ and $x_2(n)$. Now using the below steps we can easily circular convolve the two sequences.

- Firstly, we take two concentric circles. Then at the circumference of this circle we plot N samples of $x_1(n)$ with equal distance between each point. This plot is then done in an anticlockwise direction.
- In the inner circle we plot N samples of $x_2(n)$ in clockwise direction. Then the starting point is kept the same as in $x_1(n)$.
- Then we multiply the corresponding samples. The result of multiplication is added to obtain the final value.
- At last the value of the inner circle is to be rotated in an anticlockwise direction with one sample at a time.

On the other hand for "Matrix Multiplication Method", we represent the given sequences $x_1(n)$ and $x_2(n)$ in matrix form.

- The NXN matrix is formed by repeating one of the sequences. This is then achieved by making a circular shift of one sample.
- Then the Second sequence forms a column matrix.
- Finally the result of circular convolution is calculated by multiplying these two matrices.

Code:

i) For circular convolution of two signals:

```
clc
clear all
x = input('Enter the first signal: ');
h = input('Enter the second signal: ');
N = length(x);
y = zeros(1,N);
for n = 1:N
    for k = 1:N
        j = mod(n-k,N) + 1;
        y(n) = y(n) + x(k)*h(j);
    end
end

disp('Circular Convolution: ');
disp(y);
```

ii) For given two signals to show them and their summation and subtraction plots:

```
clc
clear all
n1 = [0 0 0 2 2 2 1 1 1 0 2];
subplot(4,1,1);
stem(n1);

title('First Input Signal');
n2 = [2 2 0 1 1 1 0 0 0 0 3];
subplot(4,1,2);
stem(n2);

title('Second Input Signal');
sum = n1+n2;
subplot(4,1,3);
stem(sum);
title('Summation of Input Signals');
sub = n1-n2;
subplot(4,1,4);
stem(sub);
title('Subtraction of Input Signals');
```

iii) For plotting the given figures:

```
clc
clear all
x = [0 0 2 2 2 2 0 0];
subplot(2,1,1);
plot(x);
title('Figure-1');
axis([1 8 0 3]);
y = [0 1.5 1.5 3 3 3 1.5 1.5 0];
subplot(2,1,2);
plot(y);
title('Figure-2');
axis([1 9 0 4]);
```

Input & Output :

```
Command Window
Enter the first signal: [1 2 3 4]
Enter the second signal: [1 1 1 1]
Circular Convolution:
    10    10    10    10
```

Figure-1: Input and output for circular convolution.

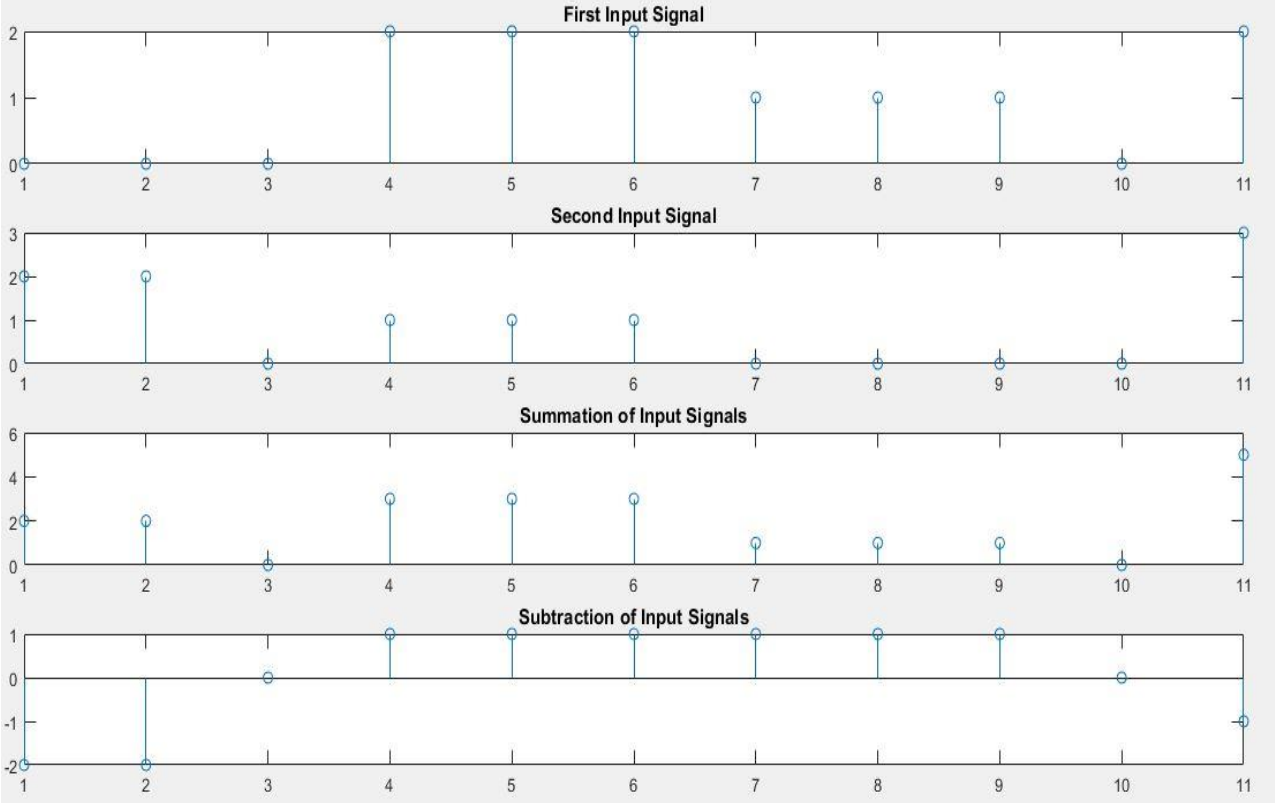

Figure-2: Output signals for given two signals and their summation and subtraction.

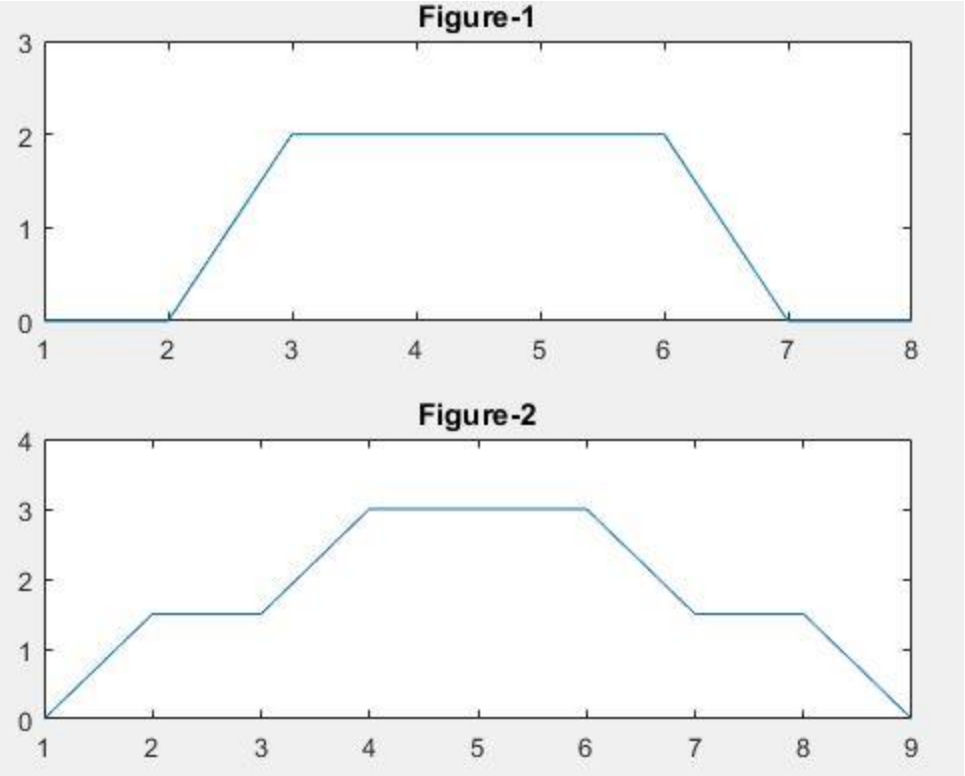

Figure-3: MATLAB plot for given two figures.

Discussion & Conclusion:

From this experiment, we had learnt about the circular convolution and we had implemented that by using matrix method. We had also implemented the summation and subtraction of two signals and also plotted given two signals by using MATLAB. Here, we got the same result as expected.