Heaven's Light is Our Guide

Rajshahi University of Engineering & Technology

Department of Electrical & Computer Engineering

Lab Report

Course Title	: Digital Signal Processing Sessional
Course No	: ECE 4124
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Experiment No: 02

Experiment Name:

Study of Circular Convolution, Basic Discrete Signal Operation & Trapezoidal Signal Generation

Theory:

Convolution is a tool that helps to determine the output of a Linear Time Invariant(LTI) system with the help of any input signal x(n) and impulse response h(n) of that specific system.

Mathematical definition of convolution for two discrete time signal is

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

Due to convolutions commutative law, both expression of convolution is right.

Code:

Circular Convolution:

```
clc
x = [ 1 2 3 4]
h = [ 1 2 3 4]

n = length(x);
anss = zeros(1,n);

k=1;
for l=1:n

    res = x * h.';
    anss(k) = res;
    k=k+1;

    first = x(1);
    for j=1:(n-1)
        x(j) = x(j+1);
    end
    x(n) = first;
```

```
20
21  end
22
23  disp(anss);
24  figure(1)
25  stem(anss);
```

Addition & subtraction of two discrete signal:

```
1   clc
2
3  n1 = [0,0,0,2,2,2,1,1,1,0,2]
4  n2 = [2 2 0 1 1 1 0 0 0 0 3]
5
6  summ = n1 + n2;
7
8  subplot(4,1,1);
9  stem(summ);
10  title('n1 signal');
11
12  subplot(4,1,2);
13  stem(summ);
14  title('n2 signal');
15
16  subplot(4,1,3);
17  stem(summ);
18  title('sum signal');
19
20  subb = n1-n2;
21  subplot(4,1,4);
22  stem(subb);
23  title('subtract signal');
24
```

Code to draw trapezoidal signal:

```
clc

t = (1:200)';

unitstep = (t>=1 & t<=50);% to generate ramp signal
ramp = t.*unitstep;


unitstep_for_step_signal = (t> 50 & t<=150);
 step_signal = 50* unitstep_for_step_signal;


 unitstep_for_negative_ramp = (t>150 & t<=200);
 negative_ramp = 200 - t.* unitstep_for_negative_ramp;
 negative_ramp = negative_ramp .* unitstep_for_negative_ramp;

 final_signal = ramp + step_signal + negative_ramp;

 plot(t, final_signal);
 ylim([0 100]);

```

Output:

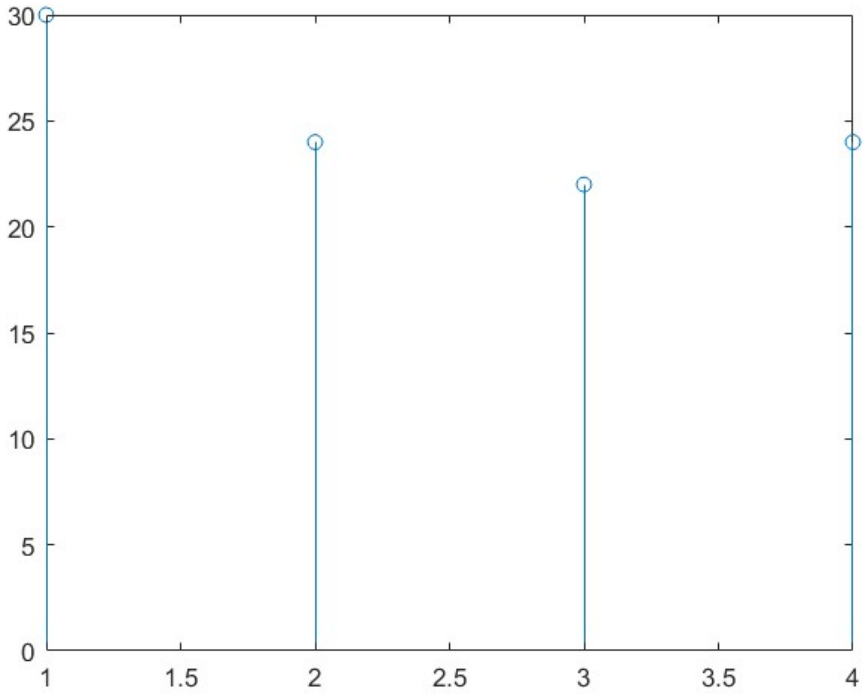

Fig. 1 Plot of circular convolution

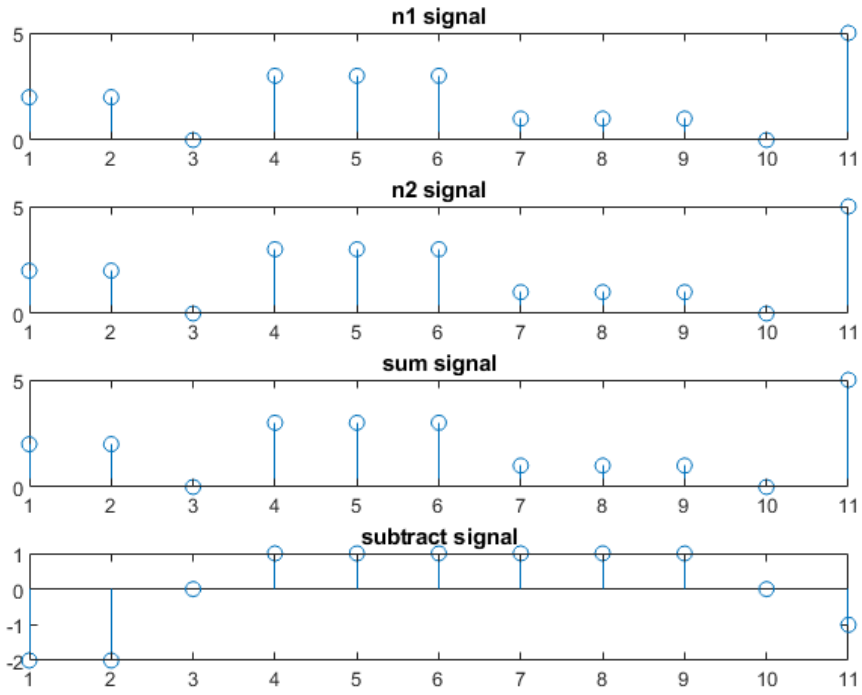

Fig. 2 Plot of summation and subtraction of two signals

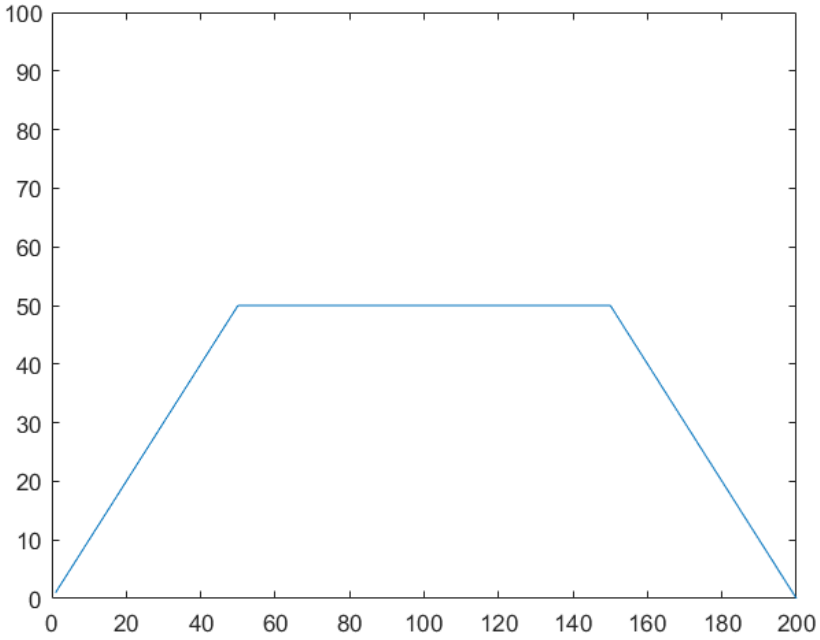

Fig. 3 Trapezoidal Signal

Discussion:

All program shows expected output and all the plots are accurate.