Heaven's Light is Our Guide

Rajshahi University of Engineering & Technology

Department of Electrical & Computer Engineering

Lab Report

Course Title	: Digital Signal Processing Sessional
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Experiment No: 01

Experiment Name:

Basic Operations on Discrete Signal and Comparison between Conv() Function and Self-made Convolution Function

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:

Basic operation on discrete signal:

```
t = 1:0.1:10;

y =@(t)sin(t);

subplot(5,1,1);
stem(t, y(t));
title('original');

subplot(5,1,2);
stem(t, y(t-1));
title('delayed');

subplot(5,1,3);
stem(t,y(t+2));
title('advance');

subplot(5,1,4);
stem(t, y(-t));
```

```
19 title('mirror');
```

Comparison of Conv() function and self-made function

```
1  clc
2  x = input('Enter the elements of function x within [ ] braket\n');
3  l = length(x);
4  h = input('Enter the elements of function h within [ ] braket\n');
5  m = length(h);
6
7  N = l + m -1;
8
9  subplot(4,1,1);
10  plot(x);
11  title('input function x(n)');
12
13  subplot(4,1,2);
14  plot(h);
15  title('impulse response function h(n)');
16
17  subplot(4,1,3);
18  y = conv(x, h);
19  plot(y);
20  title('output of conv() function');
21
22  h = flip(h,2);
23
24  res=zeros(1,N);
25
26  itr=1;
27  fprintf('Output of my code\n');
28  for i = (m-1): -1 : 0
29      y=0;
30      for k = 1:l
31          if (k+i) > m
32              break;
```

```
33          end
34          y = y +  x(k) * h(k+i);
35
36
37      end
38      fprintf('%d ',y);
39      res(itr) = y;
40      itr=itr+1;
41
42  end
43
44  lim = N - m ;
45
46  for i = 1:lim
47      y=0;
48      for k = 1:m
49          if (k+i) > l
50              break;
51          end
52          y = y +  h(k) * x(k+i);
53
54      end
55      fprintf('%d ',y);
56      res(itr) = y;
57      itr=itr+1;
58
59  end
60  fprintf('\n');
61
62
63  subplot(4,1,4);
64  plot(res);
65  title('output of self-made function');
66
```

Output:

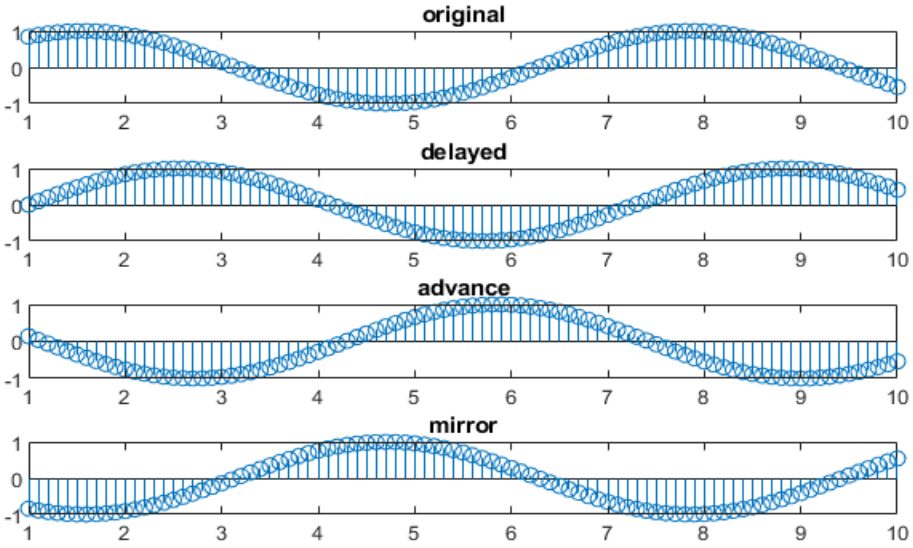

Fig. 2 Output of basic operation on discrete signal

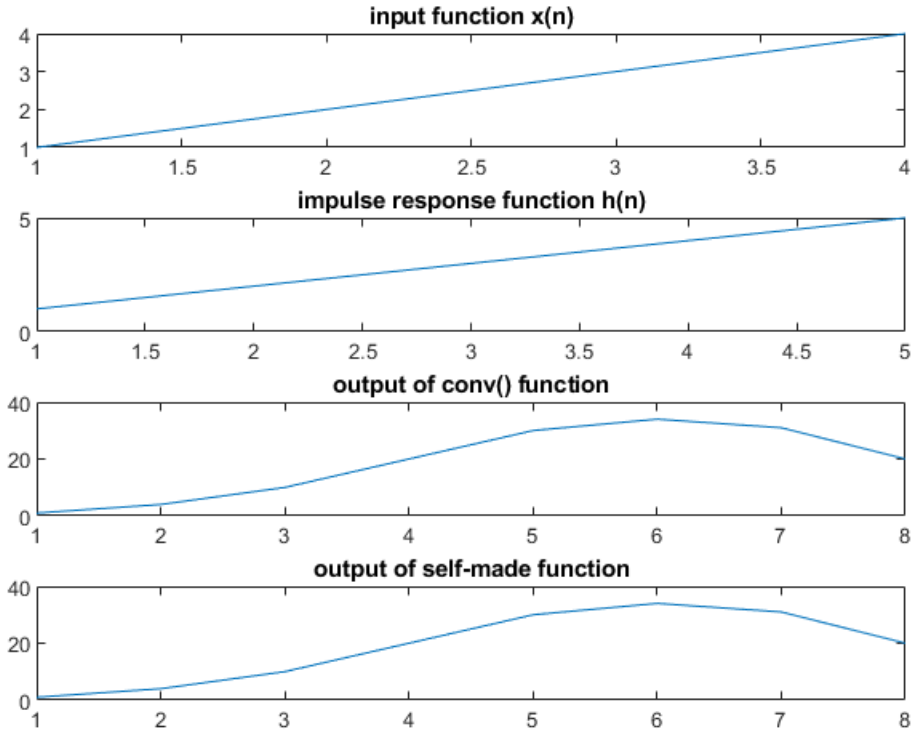

Fig. 1 Plot of all input and output function

```
Enter the elements of function x within [ ] braket
[1 2 3 4]
Enter the elements of function h within [ ] braket
[1 2 3 4 5]
output of conv() function
     1     4    10    20    30    34    31    20

Output of my code
1 4 10 20 30 34 31 20
fx >>
```

Fig. 3 Output of terminal

Discussion:

Operations on discrete signal gave proper output and self-made convolution function's output matched exactly with the built-in conv function.