

# Convolution

## 1. Linear Convolution (With Built-in Function)

Code:

```
x=input('Enter the first input sequence x[n]');
xsi=input('Enter the starting index of x[n]');
h=input('Enter the first input sequence h[n]');
hsi=input('Enter the starting index of h[n]');

y=conv(x,h);

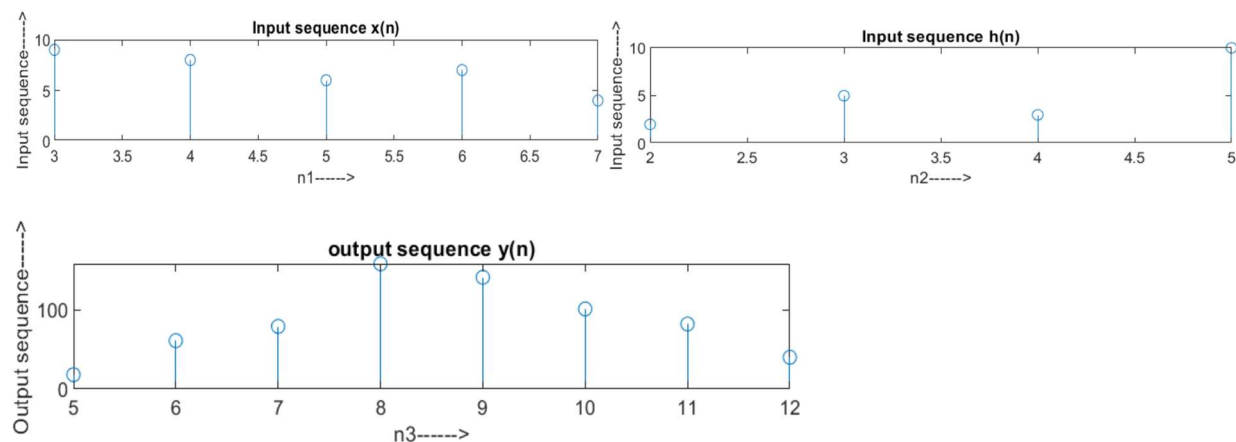
n1= xsi:1:length(x)+ xsi-1;
n2= hsi:1:length(h)+ hsi-1;
n3= xsi+hsi:1:length(x)+length(h)+hsi+xsi-2;

subplot(311);
stem(n1,x);
xlabel('n1----->')
ylabel('Input sequence----->')
title('Input sequence x(n)')

subplot(312);
stem(n2,h);
xlabel('n2----->')
ylabel('Input sequence----->')
title('Input sequence h(n)')

subplot(313);
stem(n3,y);
xlabel('n3----->')
ylabel('Output sequence----->')
title('output sequence y(n)')
```

Result:

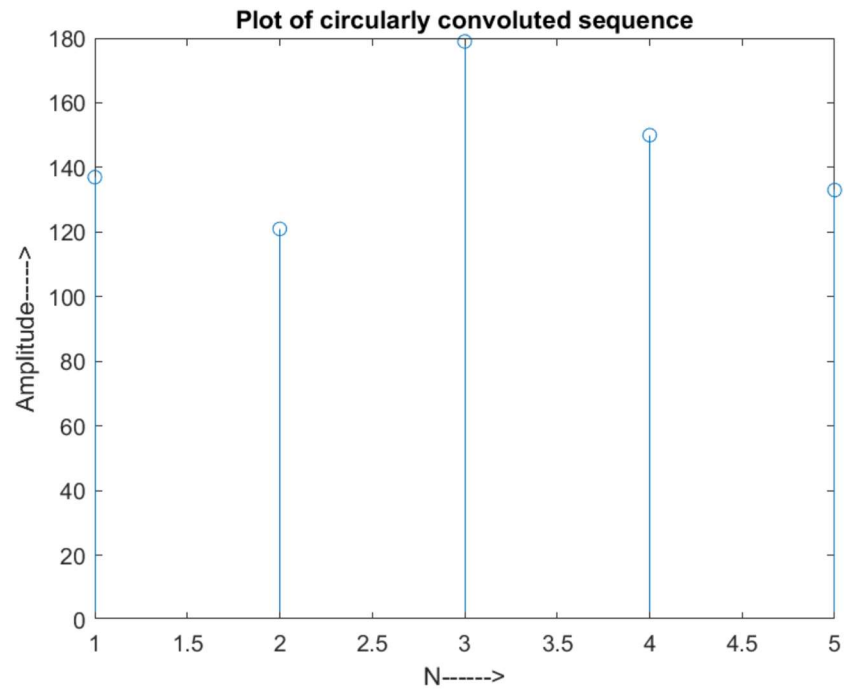


## 2. Circular Convolution (With Built-in Function):

*Code:*

```
clc
clear all;
close all;
x=input('Enter the first input sequence x[n]= ');
h=input('Enter the first input sequence h[n]= ');
N=max(length(h),length(x));
y=cconv(x,h,N);
stem(y);
xlabel('N----->')
ylabel('Amplitude----->')
title('Plot of circularly convoluted sequence')
```

**Result:**



### 3. Circular Convolution (Without Built-in Function)

Code:

```
x=input("Enter the first input sequence x[n]= ");
y=input("Enter the impulse sequence y[n]= ");
m=length(x);
n=length(y);
X=[x zeros(1,n)]; H = [y zeros(1,m)];
for i=1:m+n-1
    Y(i)=0;
    for j=1:m
        if(i-j+1>0)
            Y(i)=Y(i)+X(j)*H(i-j+1);
        else
            end
    end
end
if(m>=n)
    N=m;
else
    N=n;
end
M=length(Y);
for i=1:N
    z(i)=Y(i);
end
for j=N+1:M
    z(j-N)=z(j-N)+Y(j);
end
disp(z);
```

Result:

```
>> cir_conv_math
```

Enter the first input sequence x[n]= [2 3 4 5]

Enter the impulse sequence y[n]= [1 3 4]

33 29 21 29

#### 4. Linear Convolution (Without Built-in Function)

*Code:*

```
x = [2,3,4,5];
h = [1,2,3];
m = length(x);
n = length(h);
X = [x zeros(1,n)];
H = [h zeros(1,m)];

for i= 1:m+n-1
    Y(i)=0
    for j=1:m
        if(i-j+1>0)
            Y(i) = Y(i)+X(j)*H(i-j+1)
        else
            end
    end
end
```

Result:

```
>> convo_without_inbuilt
```

Enter the first input sequence  $x[n] = [2 \ 3 \ 1 \ 4]$

Enter the impulse sequence  $y[n] = [3 \ 2 \ 1 \ 4]$

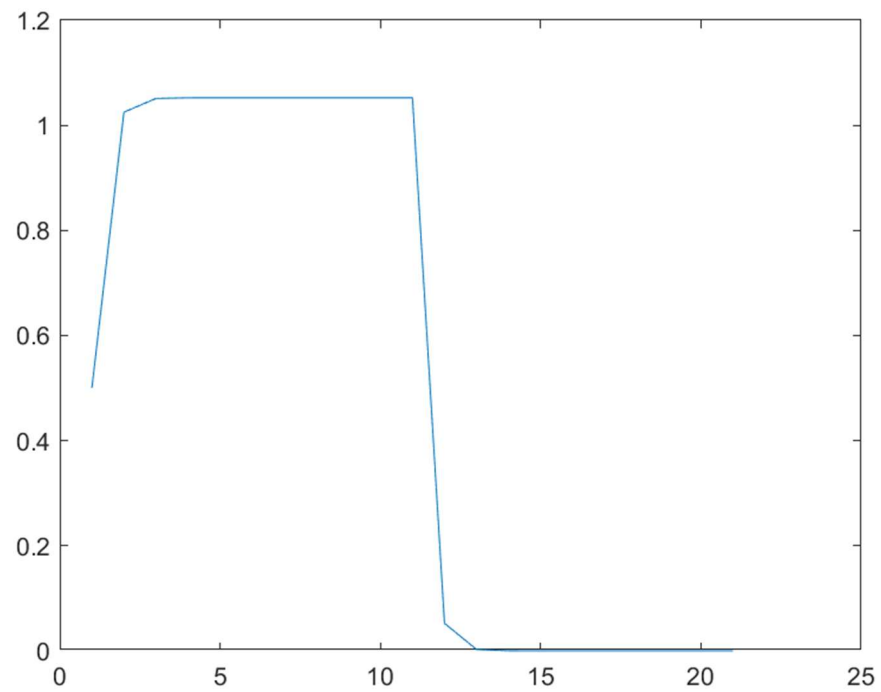
6   13   11   25   21   8   16

## 5. Continuous Convolution (With Built-in Function)

*Code:*

```
%continuous convolution with function  
clc;  
t=0:1:10;  
x=exp(-3*t);  
h=heaviside(t);  
y=conv(x,h);  
plot(y);
```

*Result:*



## 6. Continuous Convolution (Without Built-in Function)

Code:

```
%continuous convolution without inbuilt functions
clc;
syms T;
syms t;
%syms a;
x=@(t)exp(-3*t)*heaviside(t);
h=@(t)heaviside(t);
y=@(t,T)x(T)*h(t-T);
z=int(y(t,T),T,-inf,inf)
```

Result:

z =

$\text{sign}(t)/6 - (\exp(-3*t)*(\text{sign}(t)/2 + 1/2))/3 + 1/6$