The LNM Institute Of Information Technology

Department Of Electronics and Communication Engineering

DSP Lab

Name: Patel Het M. **Roll No.: 21UCC125**

1. AIM

1. Linear convolution and DFT matrix Generation.
2. Simulink based convolution.

2. Software Used

- MATLAB

3. Tasks

3.1 Generate Convolution matrix H and compare your results with MATLAB built in command for linear convolution.
3.2 Generate DFT matrix using given expression for (8,16,64) points
3.3 Utilize the DFT matrix (8, 16)points to find DFT of any given sequence and compare the results with inbuilt fft sequence.

```
function [y] = matrixMethod(x,h)
    xlen = length(x);
    hlen = length(h);
    L = xlen+hlen-1;
    D = zeros(hlen,xlen);
    for i = 1:hlen
        for j = 1:xlen
            D(i,j)=h(i).*x(j);
        end
    end

    y=zeros(1,L);
    for k = 1:L
        for i = 1:hlen
            for j = 1:xlen
                if(i+j==k+1)
                    y(k)=y(k)+D(i,j);
                end
            end
        end
    end

end
```

```
Not enough input arguments.

Error in matrixMethod (line 2)
    xlen = length(x);
```

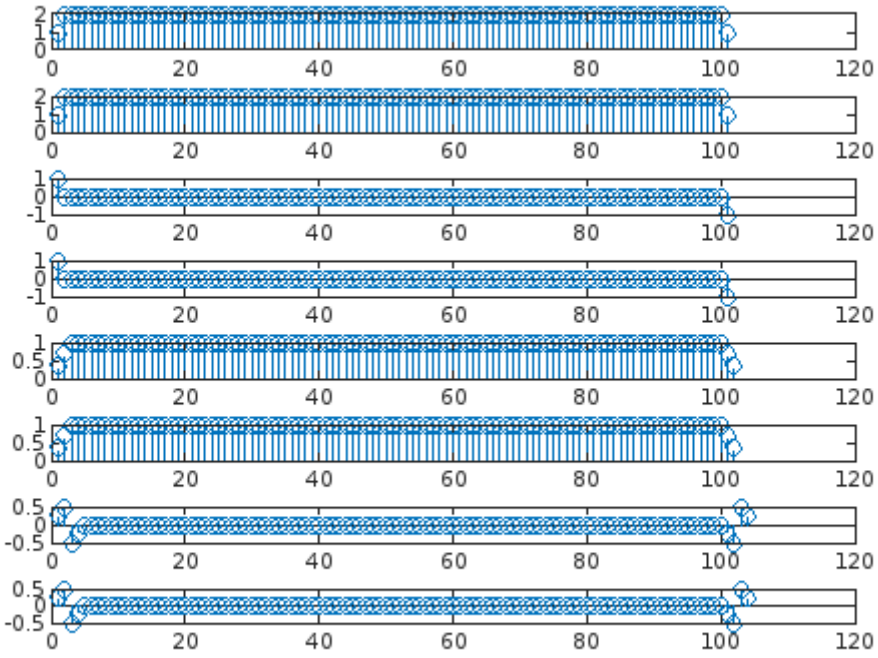
Published with MATLAB® R2023b

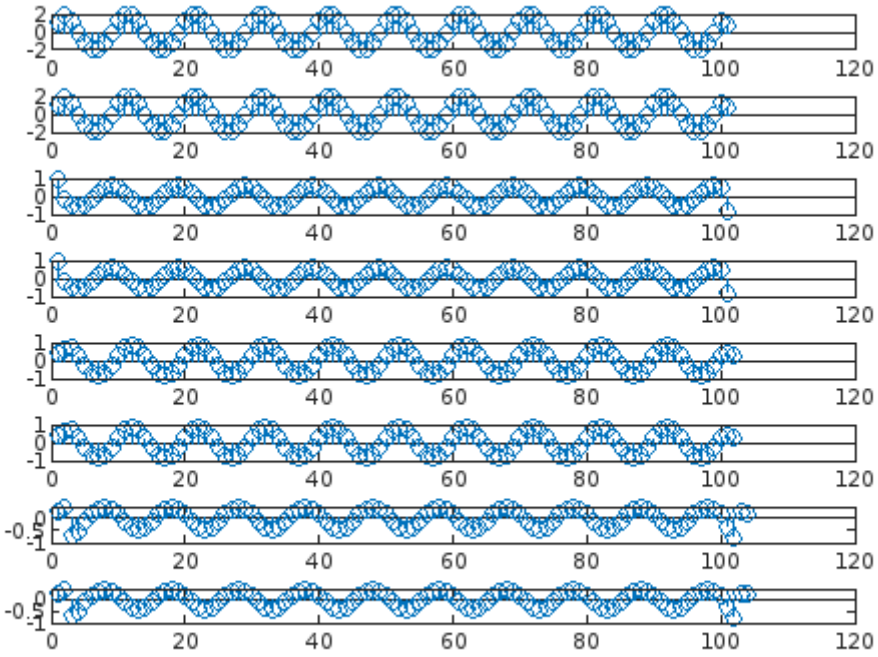
```
function[Y,H] = MyLinConv(x,h)
    m = length(x);
    n = length(h);
    L = m+n-1;
    x = [x,zeros(1,L-m)];
    h = [h,zeros(1,L-n)];
    Y = zeros(1,L);
    H = zeros(n,L);

    for i=1:L
        for j=1:m
            if(i-j+1>0)
                Y(i) = Y(i) + x(j).*h(i-j+1);
                H(j,i) = h(i-j+1);
            end
        end
    end
end
```

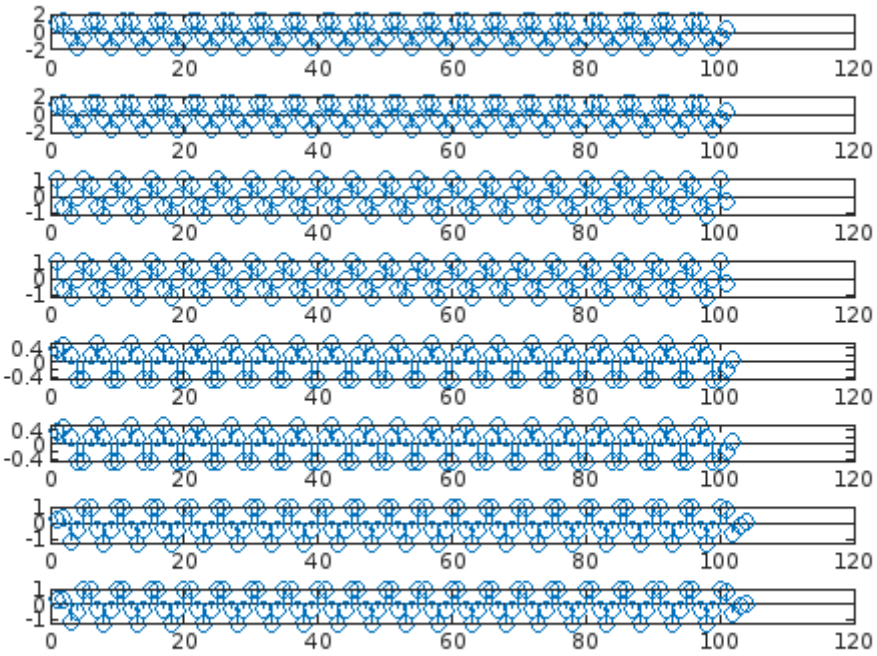
```
Not enough input arguments.

Error in MyLinConv (line 2)
    m = length(x);
```

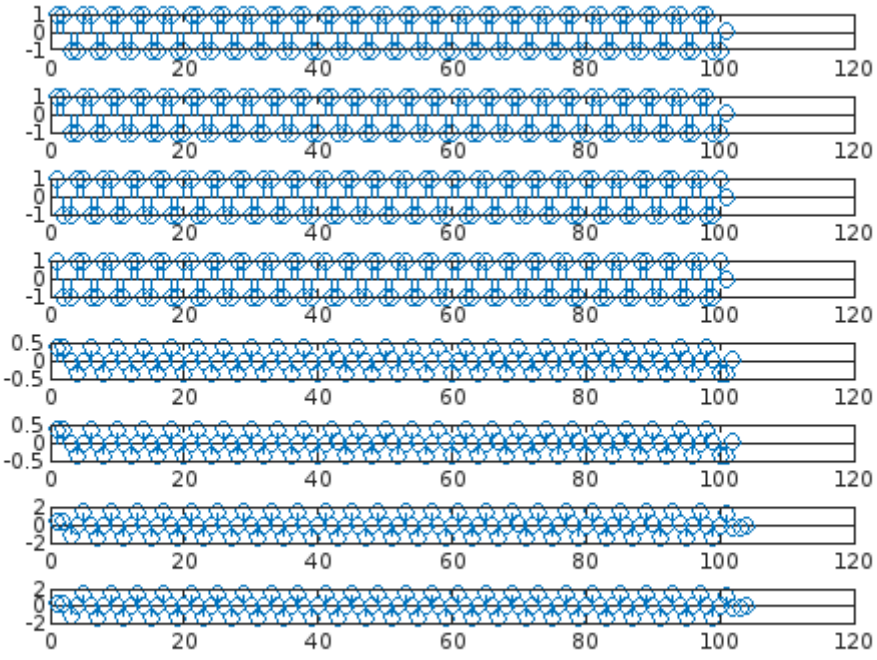
Published with MATLAB® R2023b

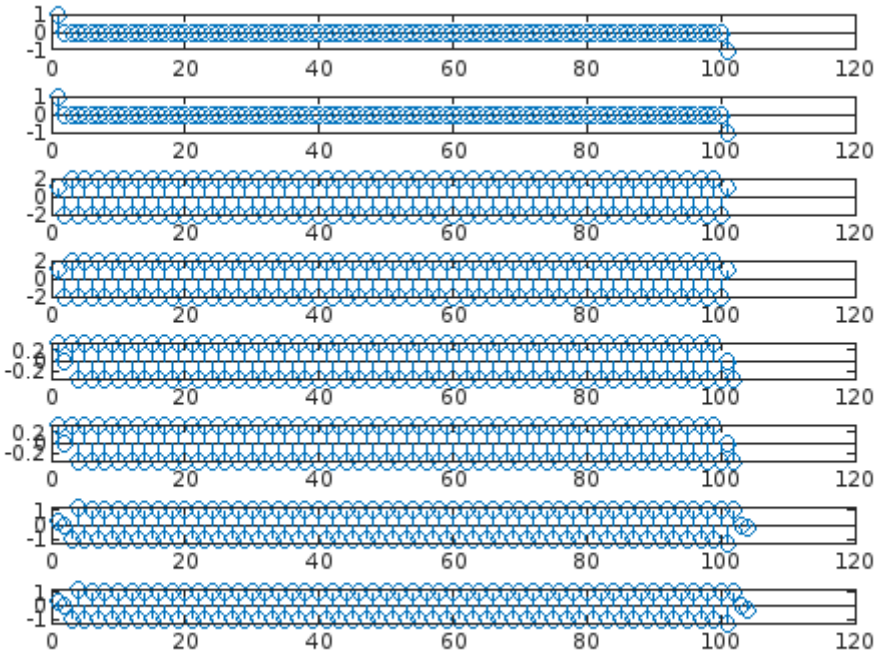
```
clc;
close all;
clear all;

n=0:99;
h1 = [1,1];
h2 = [1,-1];
h3 = (1/3)*[1,1,1];
h4 = (1/4)*[1,1,-4,1,1];
f = [0,1/10,1/5,1/4,1/2];

for i=1:length(f)
    figure;
    x = cos(2*pi*n*f(i));
    [Y1,H1] = MyLinConv(x,h1);
    subplot(8,1,1);
    stem(Y1);
    subplot(8,1,2);
    z1 = conv(x,h1);
    stem(z1);

    [Y2,H2] = MyLinConv(x,h2);
    subplot(8,1,3);
    stem(Y2);
    subplot(8,1,4);
    z2 = conv(x,h2);
    stem(z2);
    [Y3,H3] = MyLinConv(x,h3);

    subplot(8,1,5);
    stem(Y3);
    subplot(8,1,6);
    z3 = conv(x,h3);
    stem(z3);

    [Y4,H4] = MyLinConv(x,h4);
    subplot(8,1,7);
    stem(Y4);
    subplot(8,1,8);
    z4 = conv(x,h4);
    stem(z4)
end
```


2
1
0
0 20 40 60 80 100 120
2
1
0
0 20 40 60 80 100 120
1
0
-1
0 20 40 60 80 100 120
1
0
-1
0 20 40 60 80 100 120
1
0.5
0
0 20 40 60 80 100 120
1
0.5
0
0 20 40 60 80 100 120
0.5
0
-0.5
0 20 40 60 80 100 120
0.5
0
-0.5
0 20 40 60 80 100 120


2
0
-2
0 20 40 60 80 100 120
2
0
-2
0 20 40 60 80 100 120
1
0
-1
0 20 40 60 80 100 120
1
0
-1
0 20 40 60 80 100 120
1
0
-1
0 20 40 60 80 100 120
1
0
-1
0 20 40 60 80 100 120
0
-0.5
-1
0 20 40 60 80 100 120
0
-0.5
-1
0 20 40 60 80 100 120


2
0
-2
0 20 40 60 80 100 120
2
0
-2
0 20 40 60 80 100 120
1
0
-1
0 20 40 60 80 100 120
1
0
-1
0 20 40 60 80 100 120
0.4
0
-0.4
0 20 40 60 80 100 120
0.4
0
-0.4
0 20 40 60 80 100 120
1
0
-1
0 20 40 60 80 100 120
1
0
-1
0 20 40 60 80 100 120

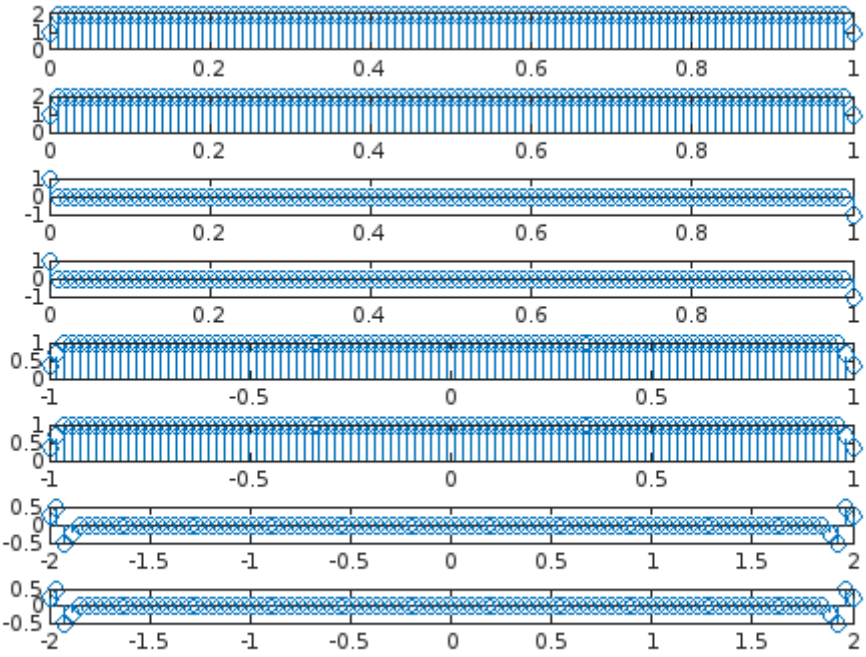

1
0
-1
0 20 40 60 80 100 120
1
0
-1
0 20 40 60 80 100 120
1
0
-1
0 20 40 60 80 100 120
1
0
-1
0 20 40 60 80 100 120
0.5
0
-0.5
0 20 40 60 80 100 120
0.5
0
-0.5
0 20 40 60 80 100 120
2
0
-2
0 20 40 60 80 100 120
2
0
-2
0 20 40 60 80 100 120

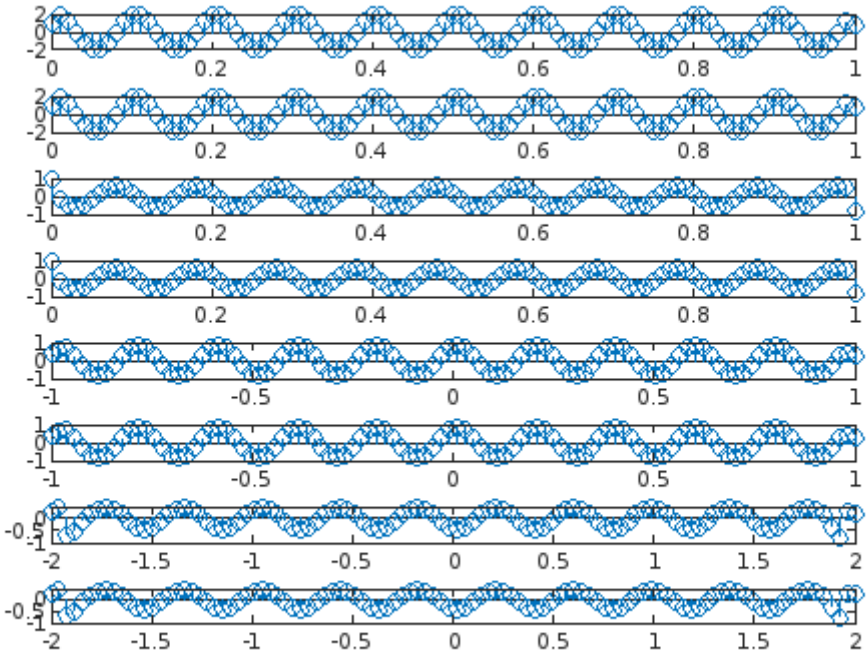


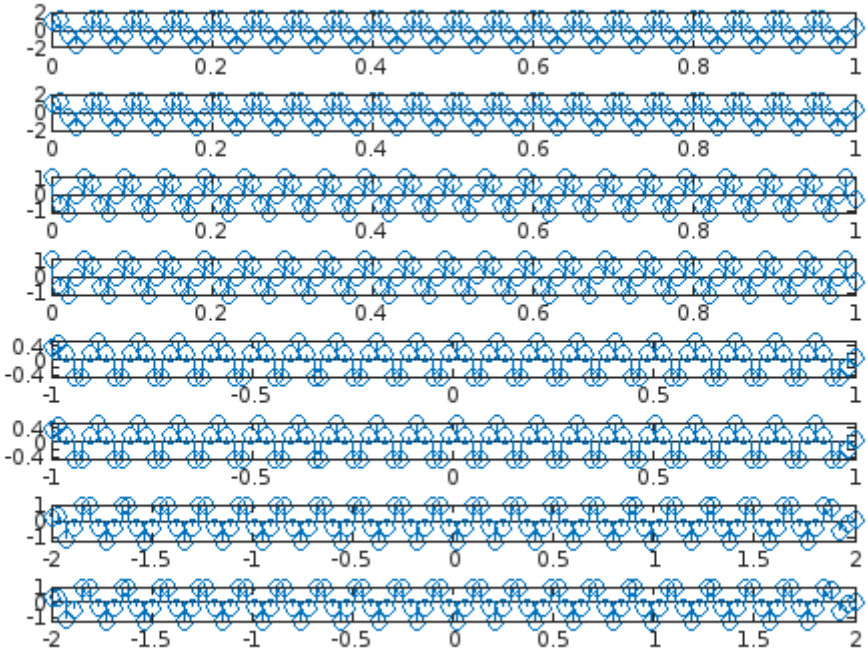
Published with MATLAB® R2023b

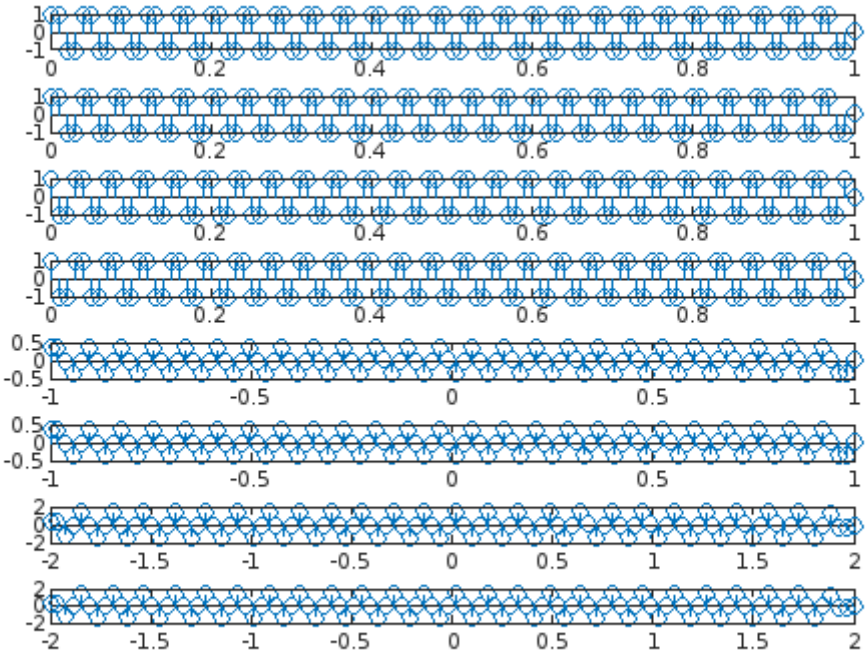
```
clc;
close all;
clear all;

n=0:99;
h1 = [1,1];
h2 = [1,-1];
h3 = (1/3)*[1,1,1];
h4 = (1/4)*[1,1,-4,1,1];
f = [0,1/10,1/5,1/4,1/2];

n1 = 0:1;
n2 = 0:1;
n3 = 1:1;
n4 = 2:2;

clc;
close all;
clear all;

n=0:99;
h1 = [1,1];
h2 = [1,-1];
h3 = (1/3)*[1,1,1];
h4 = (1/4)*[1,1,-4,1,1];
f = [0,1/10,1/5,1/4,1/2];

for i=1:length(f)
    figure;
    x = cos(2*pi*n*f(i));
    y1 = MyLinConv(x,h1);
    y2 = MyLinConv(x,h2);
    y3 = MyLinConv(x,h3);
    y4 = MyLinConv(x,h4);

    n1 = linspace(0,1,length(y1));
    n2 = linspace(0,1,length(y2));
    n3 = linspace(-1,1,length(y3));
    n4 = linspace(-2,2,length(y4));


    [Y1,H1] = MyLinConv(x,h1);
    subplot(8,1,1);
    stem(n1,y1);
    subplot(8,1,2);
    z1 = conv(x,h1);
    stem(n1,z1);

    [Y2,H2] = MyLinConv(x,h2);
    subplot(8,1,3);
    stem(n2,y2);
    subplot(8,1,4);
```

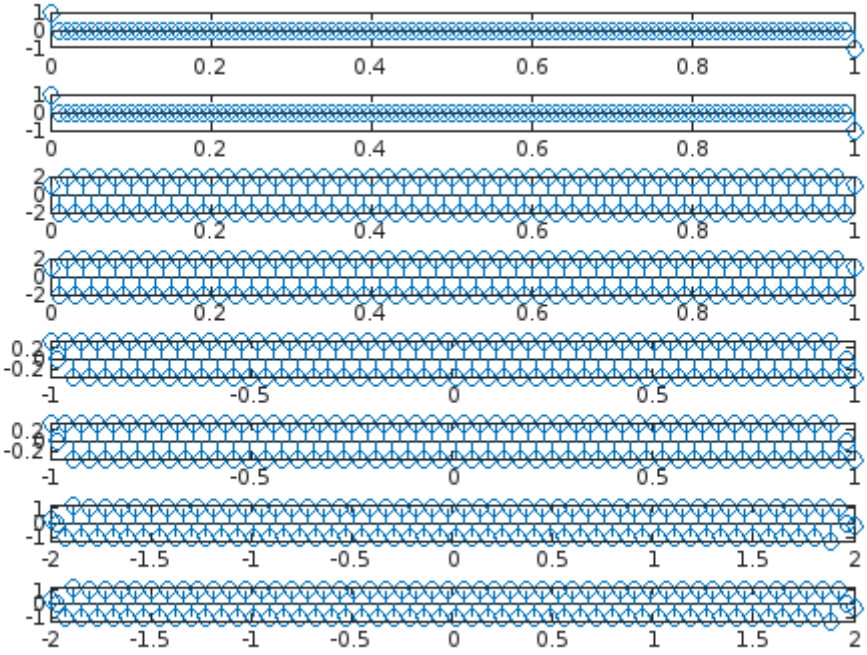
```
    z2 = conv(x,h2);
    stem(n2,z2);

    [Y3,H3] = MyLinConv(x,h3);
    subplot(8,1,5);
    stem(n3,y3);
    subplot(8,1,6);
    z3 = conv(x,h3);
    stem(n3,z3);

    [Y4,H4] = MyLinConv(x,h4);
    subplot(8,1,7);
    stem(n4,y4);
    subplot(8,1,8);
    z4 = conv(x,h4);
    stem(n4,z4)
end
```











Published with MATLAB® R2023b

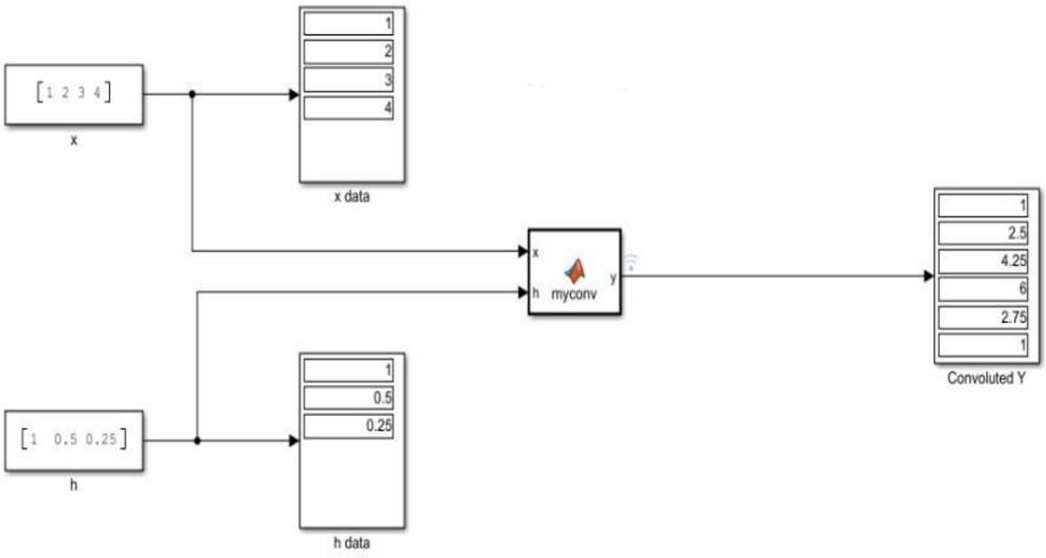


Figure 1: Simulink