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# EED364 : Graph Signal Processing [ Lab-4 ]

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## Objective:

Eigen spectrum with respect to Adjacency matrix of a Graph

## Program:

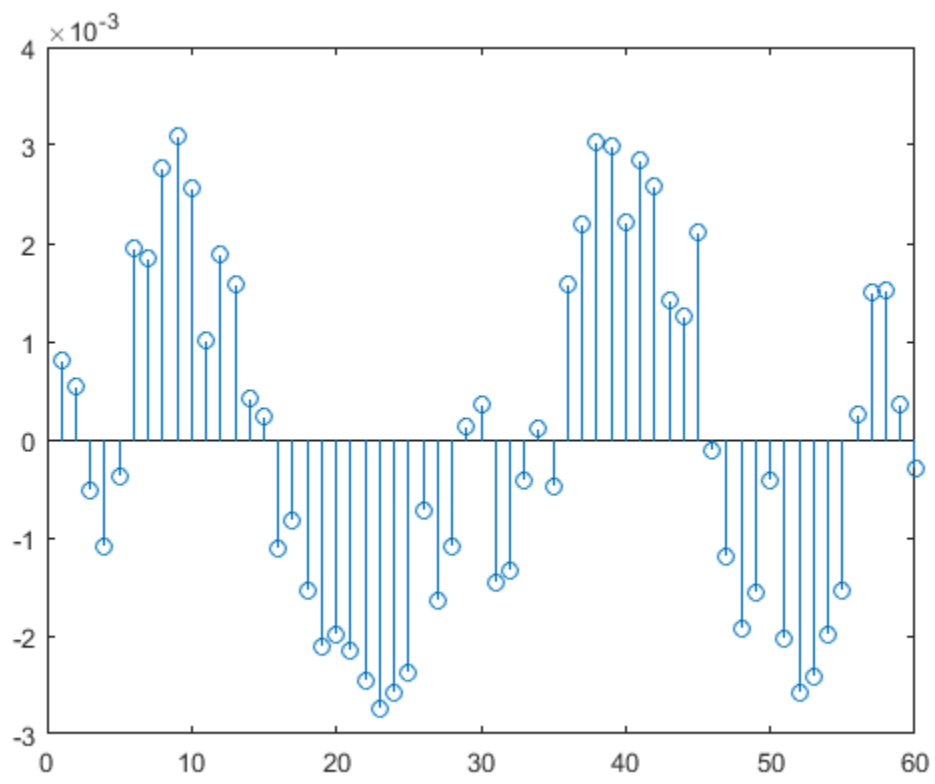
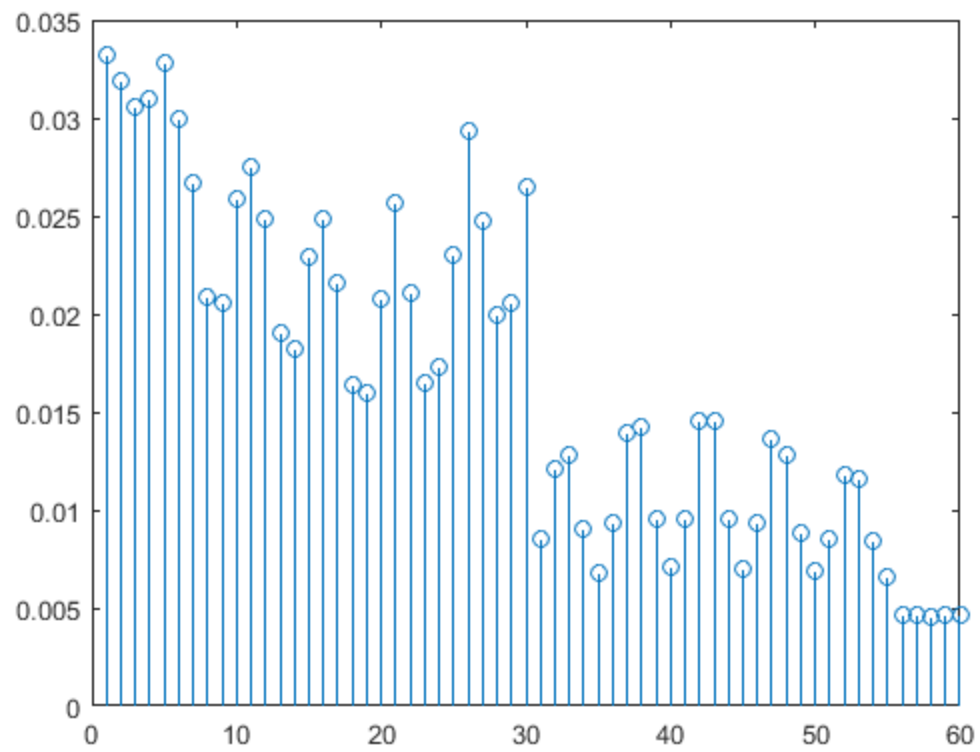
```
clc;
clear all;
close all;

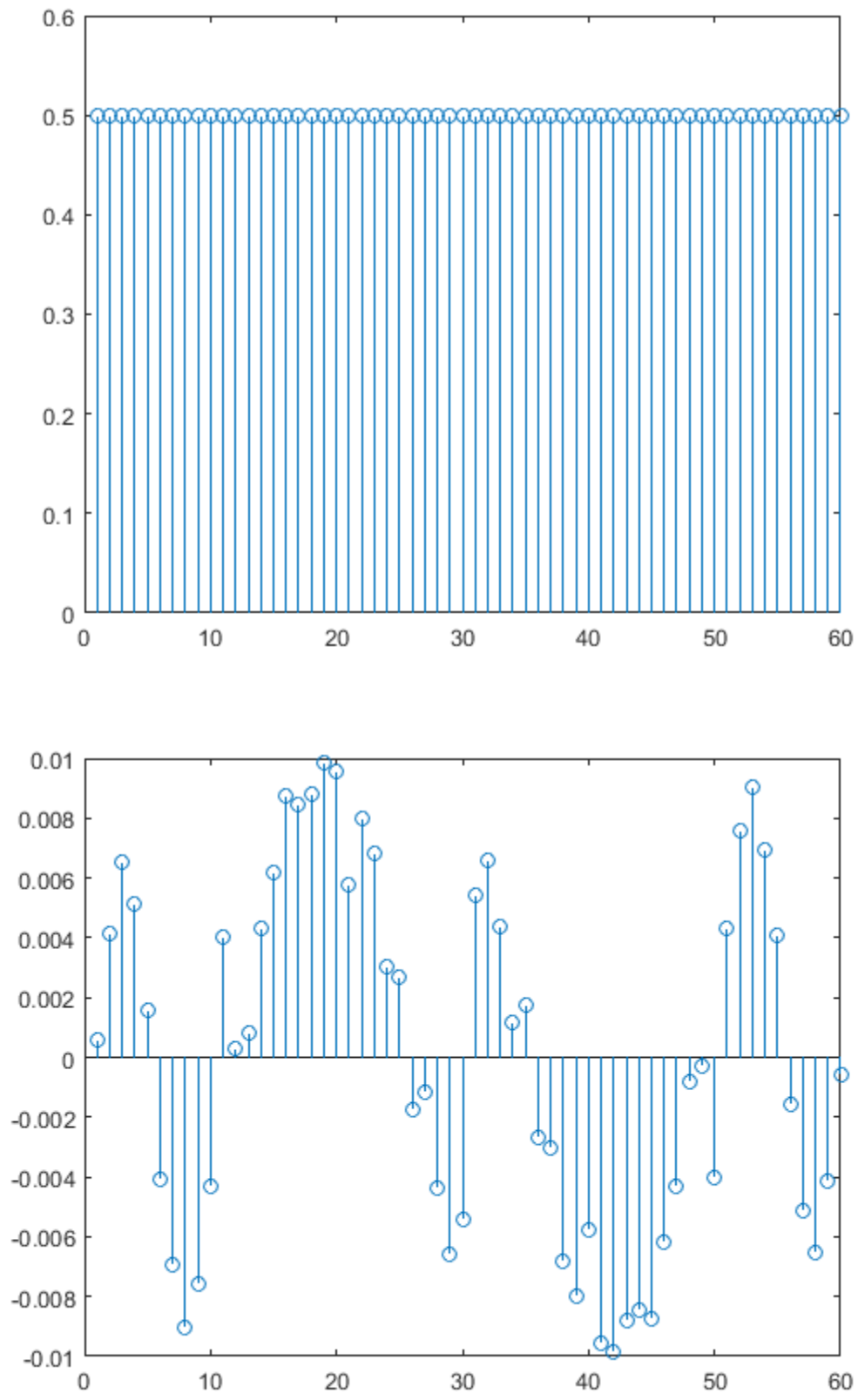
[Bu, XY ]= bucky;
L=laplacian(Bu);
%{
function [L] = laplacian(A)
m= size(A,1);
D =diag(sum(ceil(A),2));
L=D-ceil(A);
end
%}

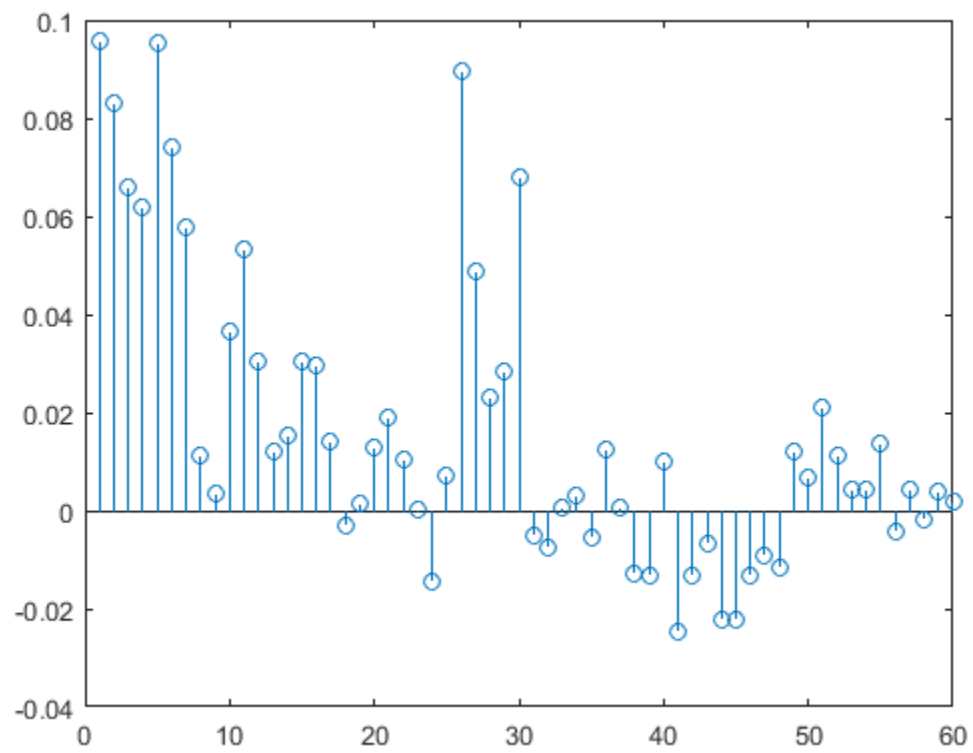
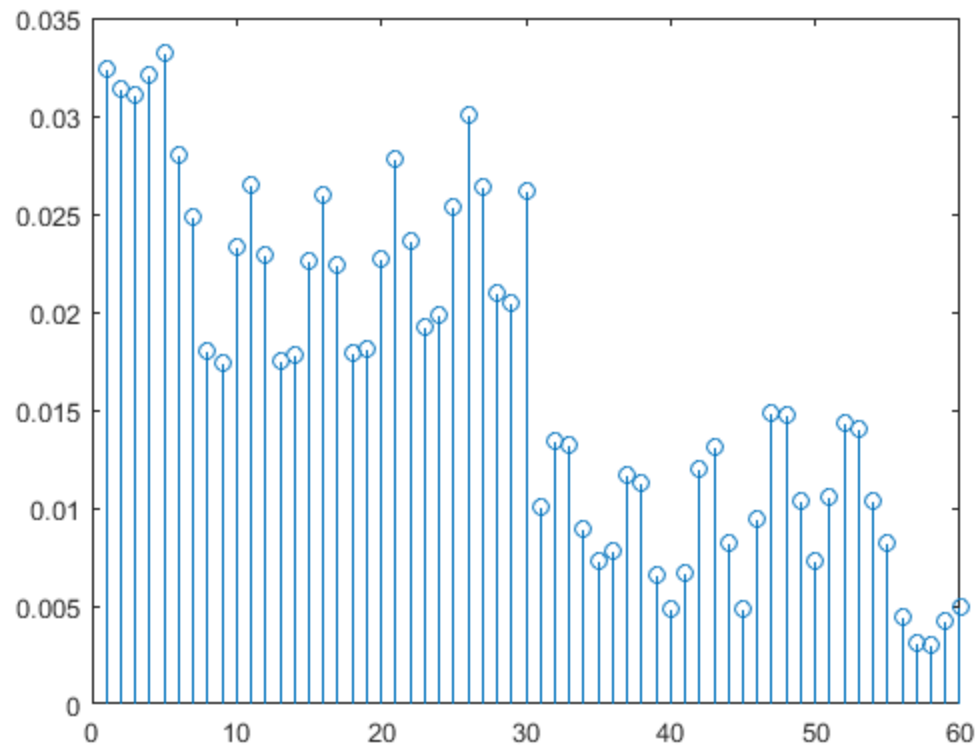
[U, D]=eig(full(L));
load('inputSignal.mat');
x=inputSignal;
X=U'*x;
load('inputSignal1.mat');
x1=inputSignal1;
X1=U'*x1;
h1=[0.5;0.5];
h1=[h1; zeros(size(U,2)-size(h1,1),1)];
H=U'*h1;
h2=[0.5;-0.5];
```

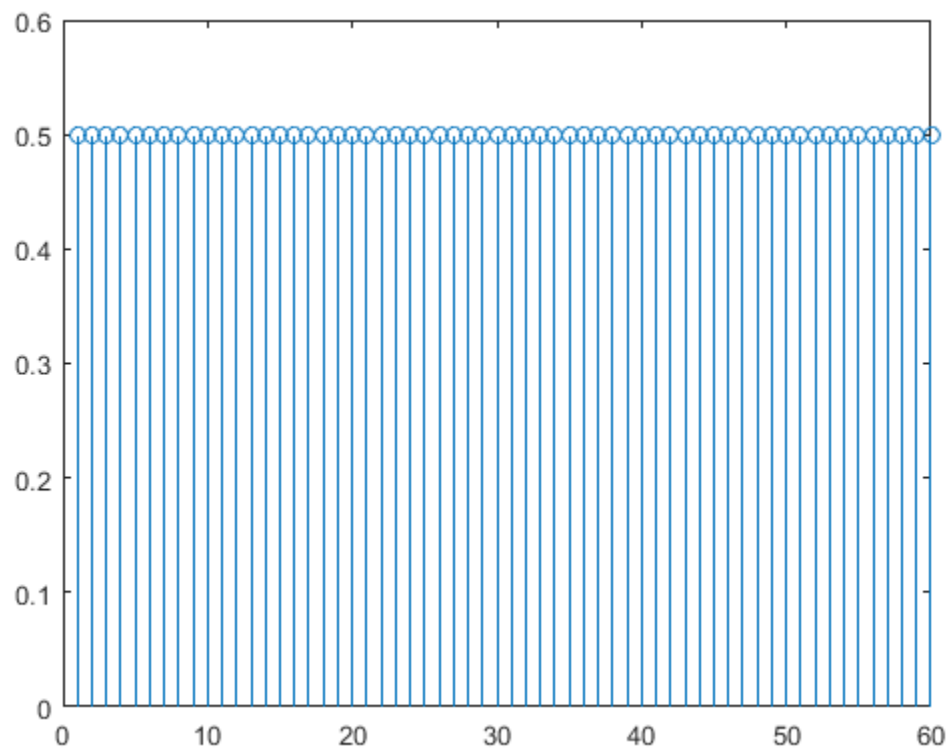
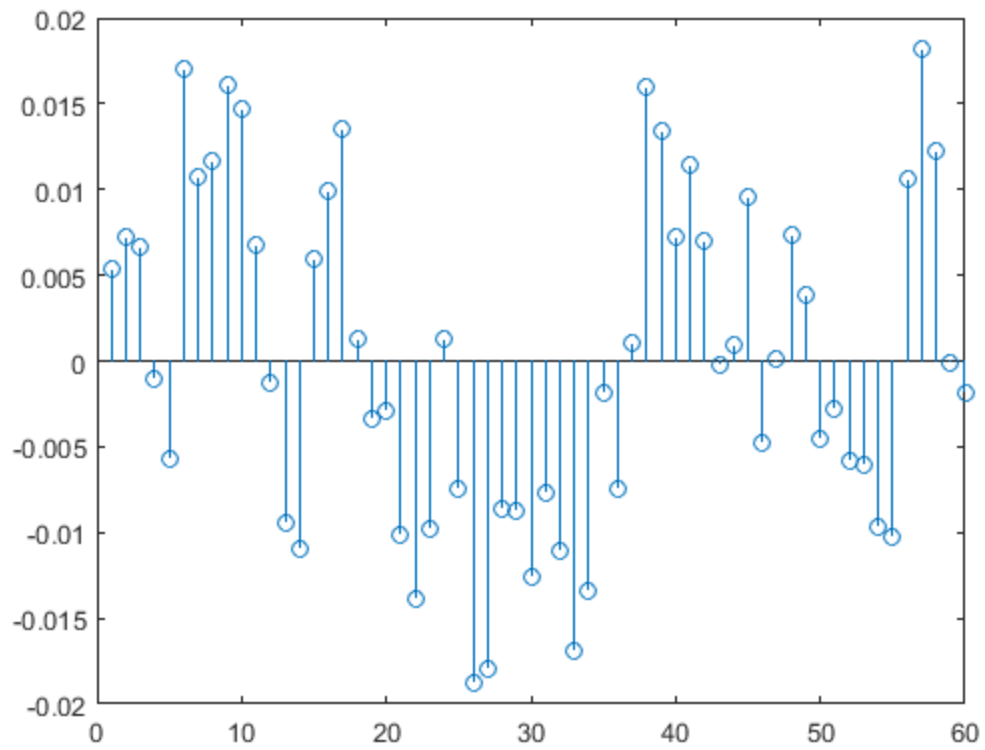
```
h2=[h2; zeros(size(U,2)-size(h2,1),1)];
H2=U'*h2;
h3=0.5*ones(size(U,2),1);
H3=U'*h3;
for i=1:2:size(U,1)
    h4(i,1)=0.5;
    h4(i+1,1)=-0.5;
end
H4=U'*h4;
h5=[0;1];
h5=[h5; zeros(size(U,2)-size(h5,1),1)];
H5=U'*h5;

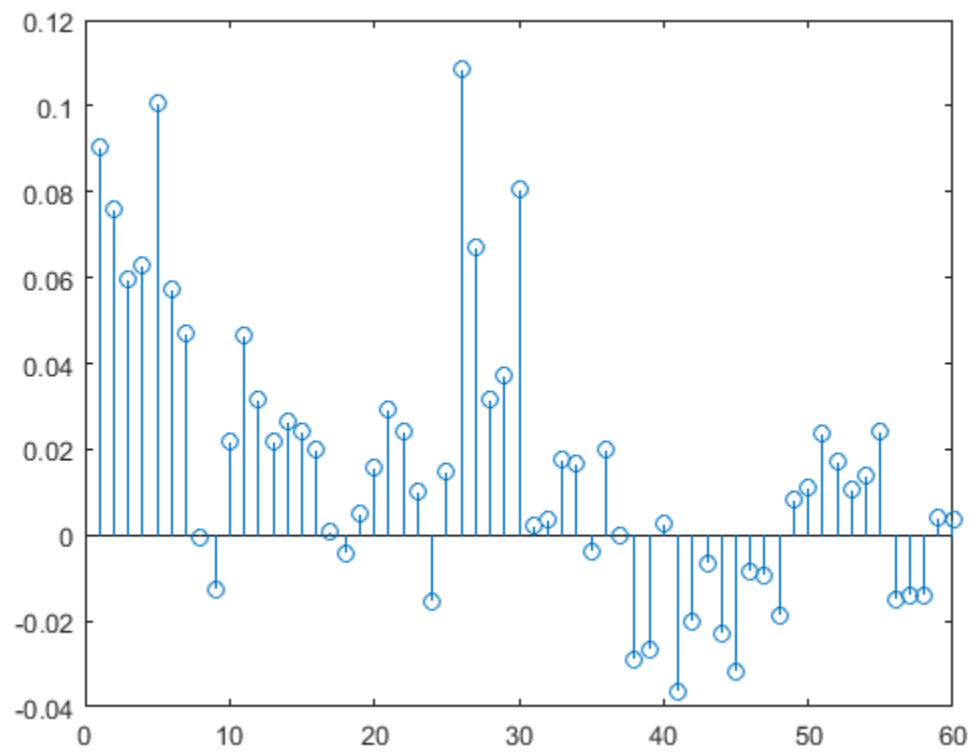
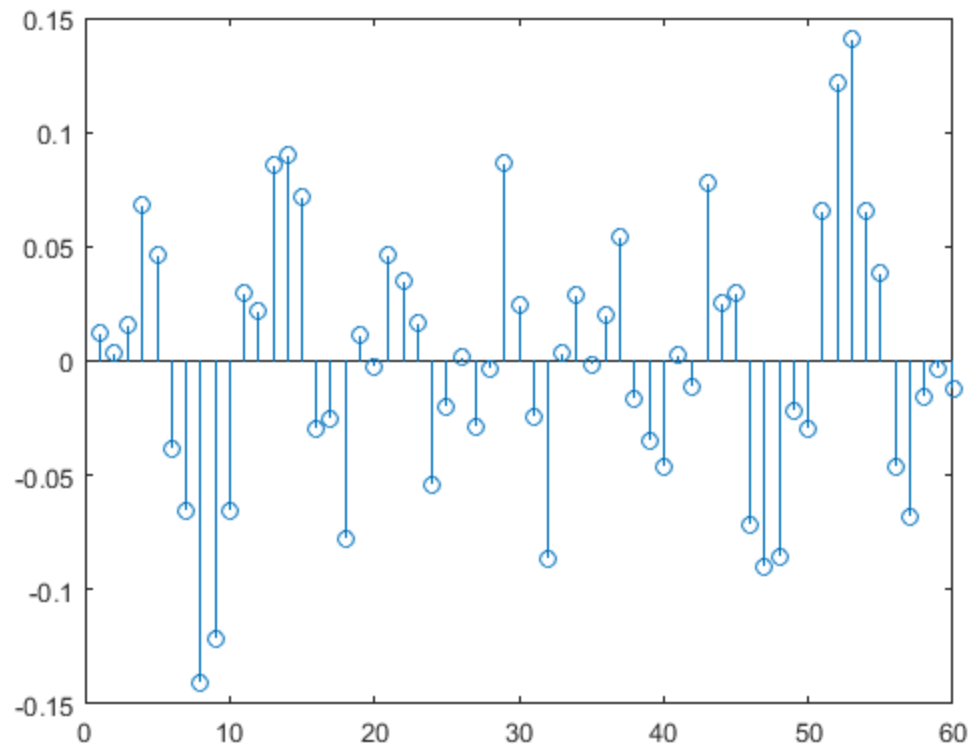
%{
function[y]=conv(X,H,U)
    Y=X.*H;
    y=U*Y;
    figure;
    stem(y);
end
%}
y1=conv(X,H,U);
y2=conv(X,H2,U);
y3=conv(X,H3,U);
y4=conv(X,H4,U);
y5=conv(X,H5,U);
y11=conv(X1,H,U);
y22=conv(X1,H2,U);
y33=conv(X1,H3,U);
y43=conv(X1,H4,U);
y55=conv(X1,H5,U);
```







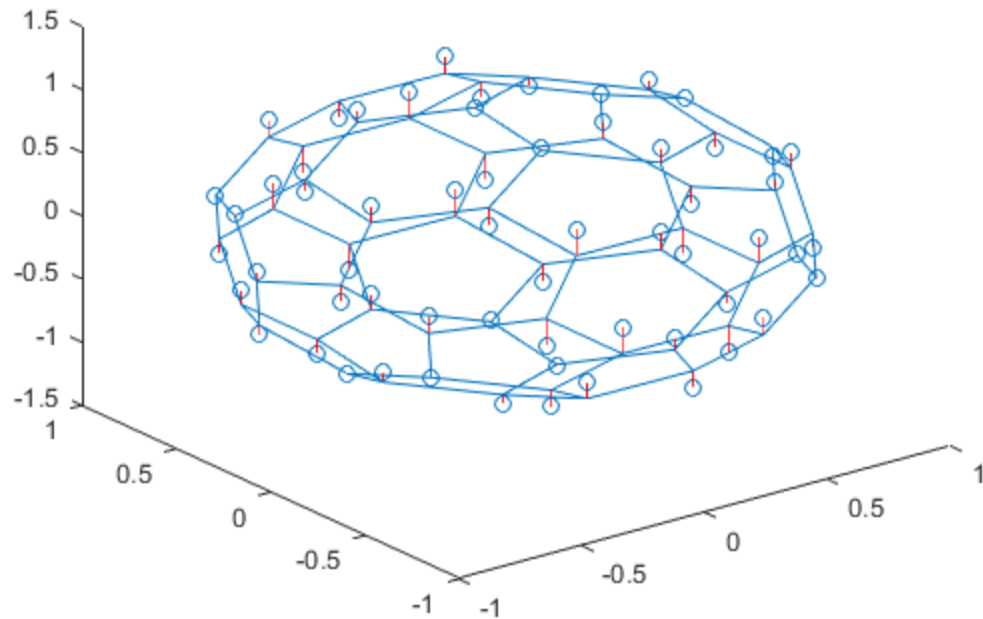




## Plot the highest variation signals( defined in 1) on the bucky ball graph

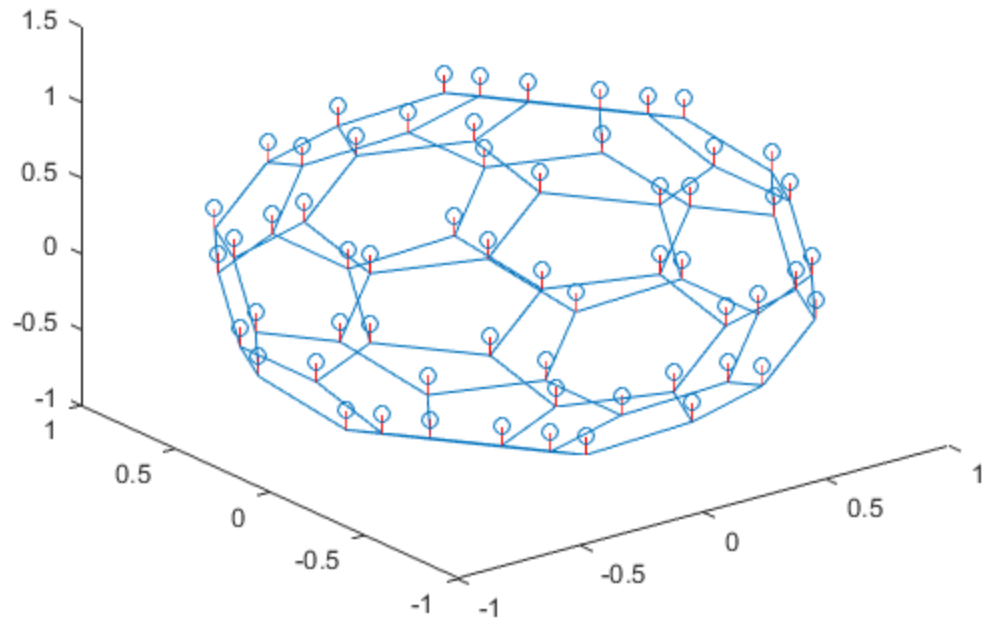
```
E=sortrows([diag(D) U']);
Us=E(:,2:size(E,1)+1)';
S=Us(:,size(E,1));
my3dplot(Bu,S,XY);
%{
function [] = my3dplot(A,B,X)
[m n]=size(A);
    for i=1:m
        text(B(i,1),B(i,2),B(i,3),'*');
        for j=i:m
            if(A(i,j)==1)
                hold on;
                line([B(i,1),B(j,1)],[B(i,2),B(j,2)],
[B(i,3),B(j,3)]);
            end
        end
        l= line([B(i,1),B(i,1)],[B(i,2),B(i,2)],[B(i,3),
(B(i,3)+X(i,1))]);
        set(l,'color','red');
    end
end
%}
```





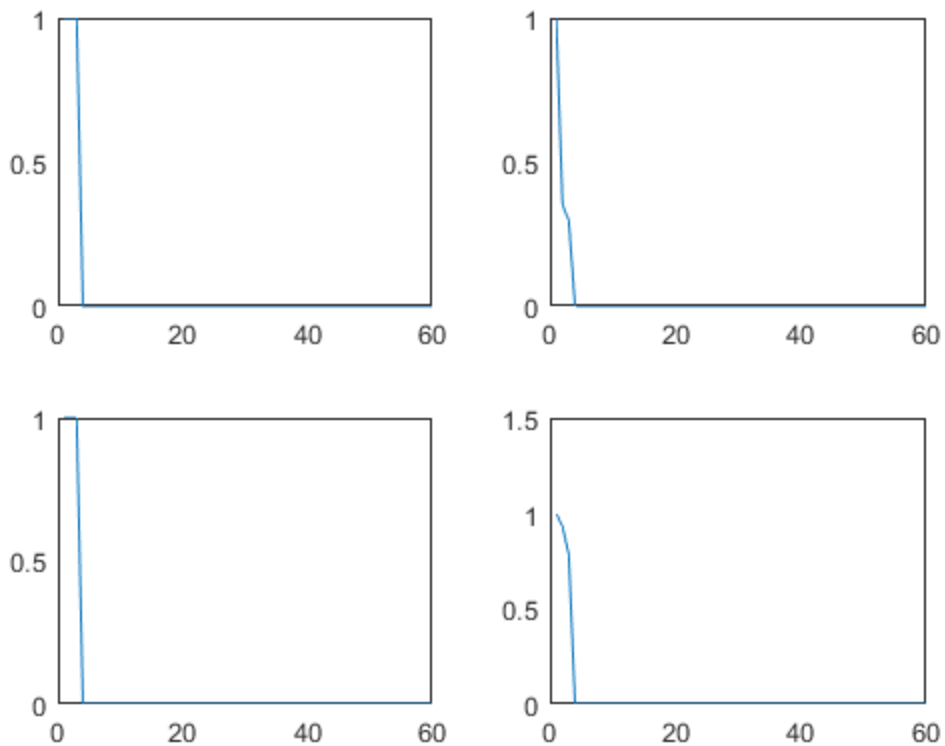
**Plot the zero variation signals ( defined on 1)  
on same graph.**

```
my3dplot(Bu,Us(:,1),XY);
```



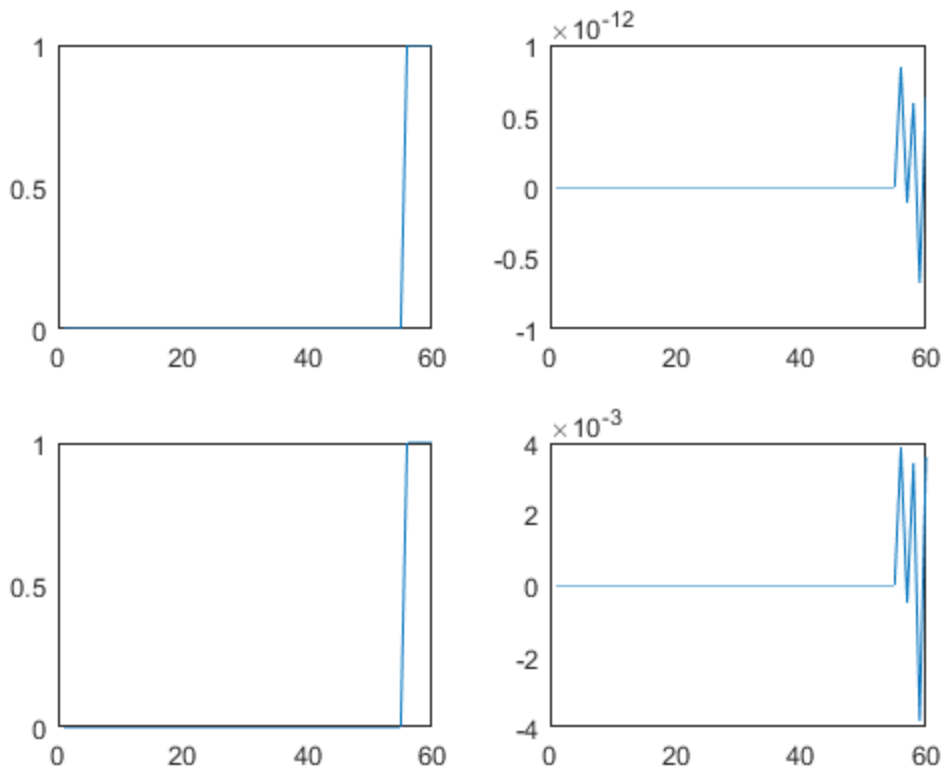
**Define Low pass filter in GFT domain ( passing only smallest three variations)**

```
H1=[1;1;1];  
H1=[H1; zeros(size(x,1)-size(H1,1),1)];  
figure;  
O11=X.*H1;  
subplot(2,2,1);  
plot(H1);  
subplot(2,2,2);  
plot(O11);  
O21=X1.*H1;  
subplot(2,2,3);  
plot(H1);  
subplot(2,2,4);  
plot(O21);
```



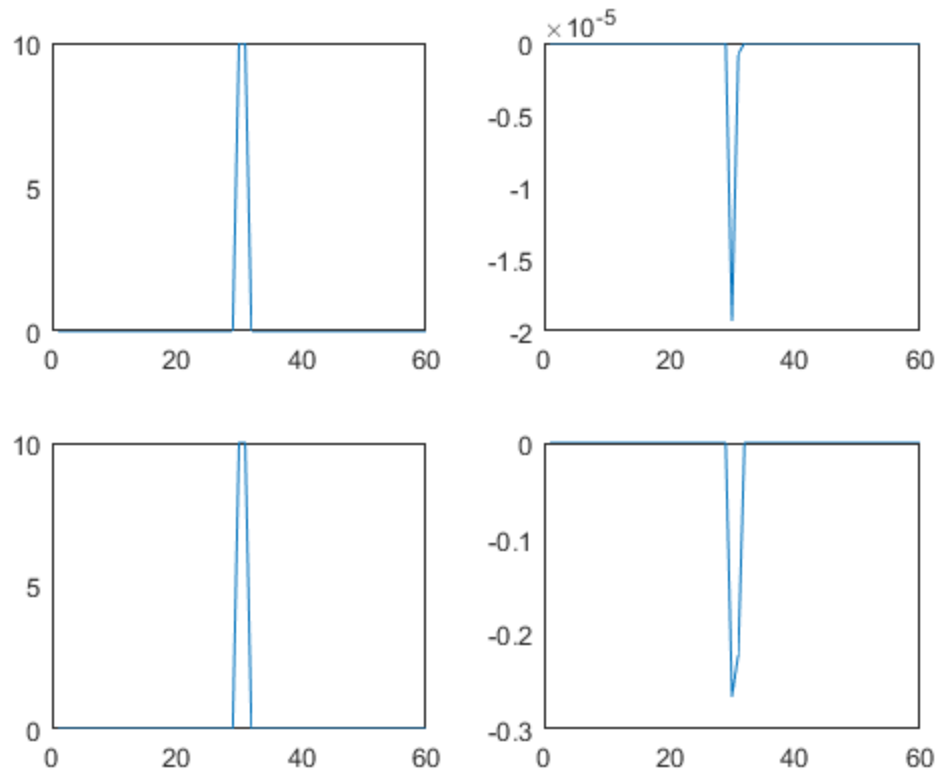
**define High pass filter in GFT domain ( passing only 5 high variations)**

```
H2=zeros(size(x,1)-5,1);  
H2=[H2;ones(5,1)];  
O12=X.*H2;  
figure;  
subplot(2,2,1);  
plot(H2);  
subplot(2,2,2);  
plot(O12);  
O22=X1.*H2;  
subplot(2,2,3);  
plot(H2);  
subplot(2,2,4);  
plot(O22);
```



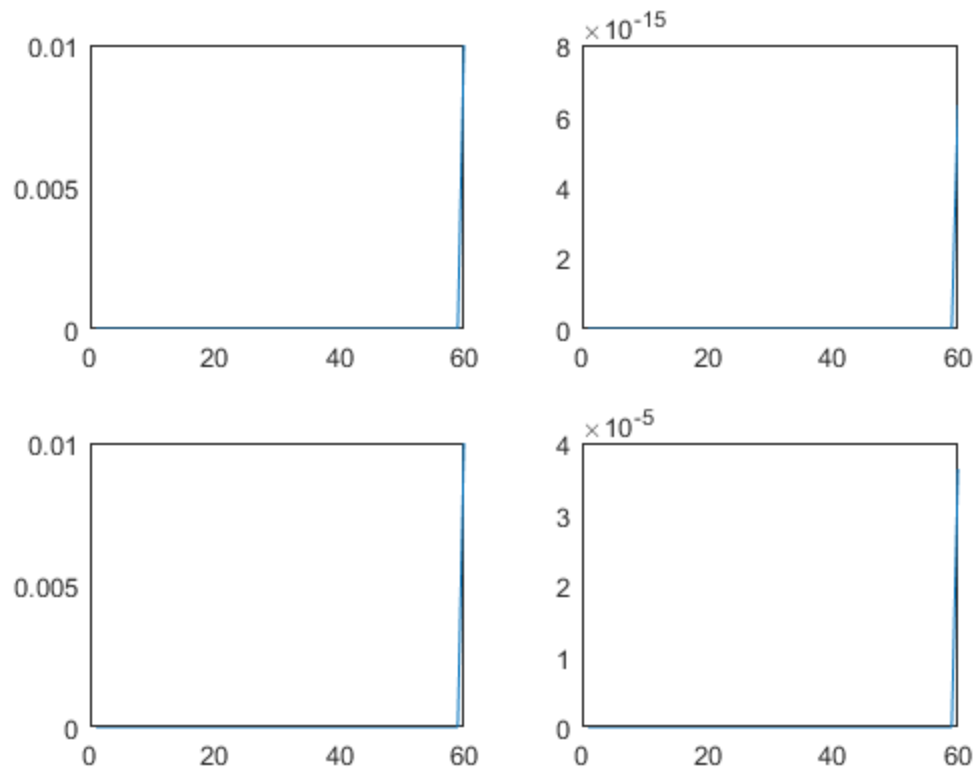
**define Bandpass filter, which maximizing middle variation by 10**

```
H3=zeros(size(x,1),1);
H3(size(x,1)/2,1)=10;
H3((size(x,1)/2)+1,1)=10;
O13=X.*H3;
figure;
subplot(2,2,1);
plot(H3);
subplot(2,2,2);
plot(O13);
O23=X1.*H3;
subplot(2,2,3);
plot(H3);
subplot(2,2,4);
plot(O23);
```



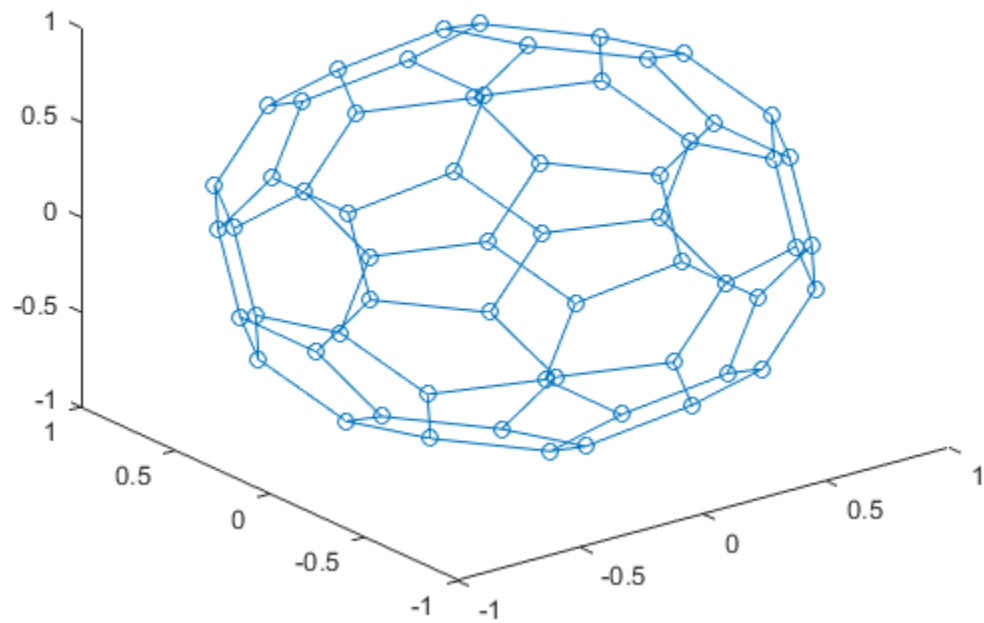
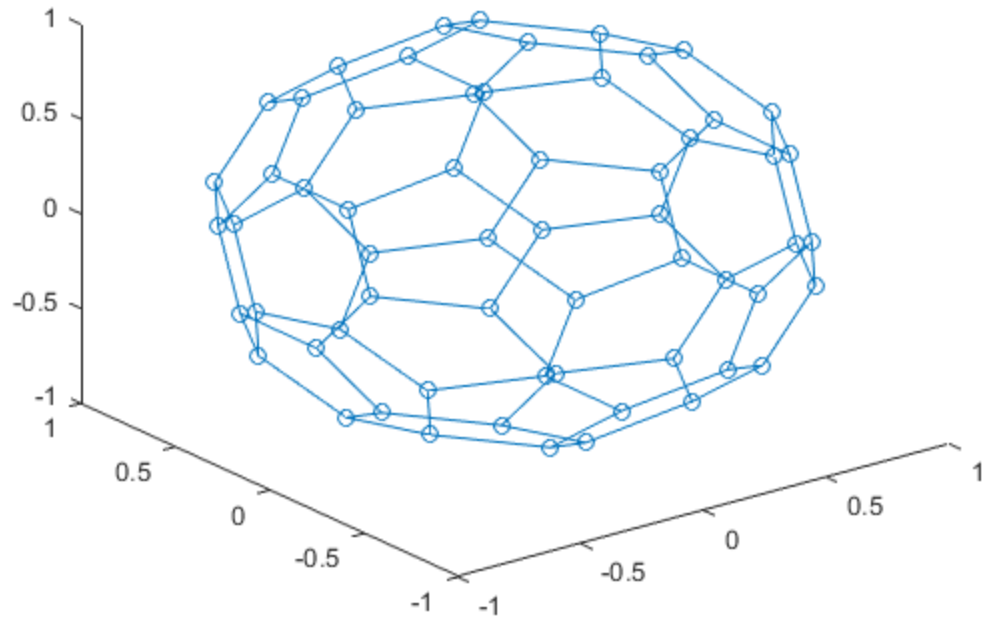
**Define Bandstop filter which minimizes highest variation by 40 dB**

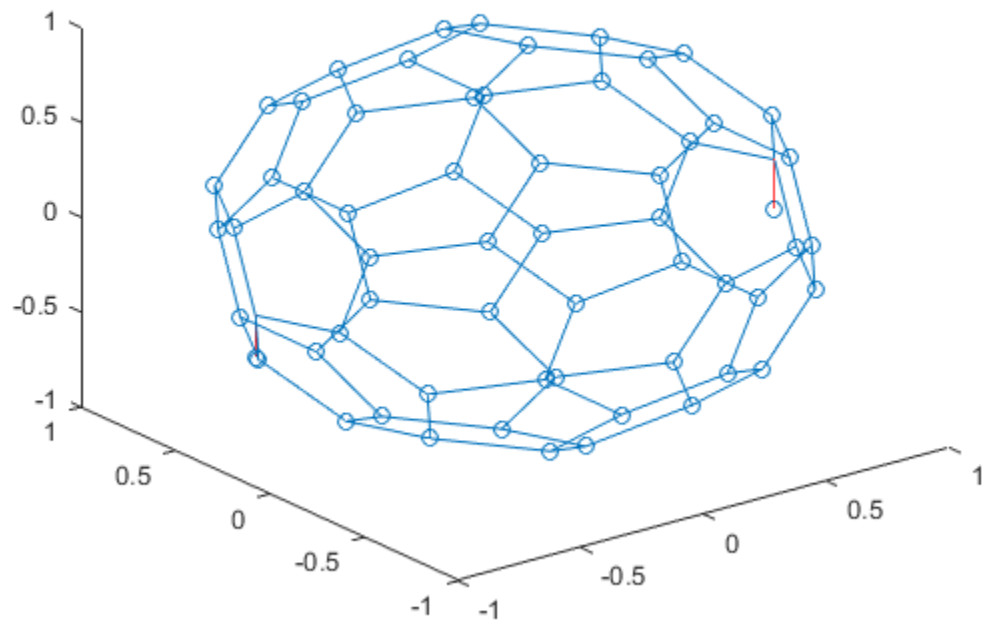
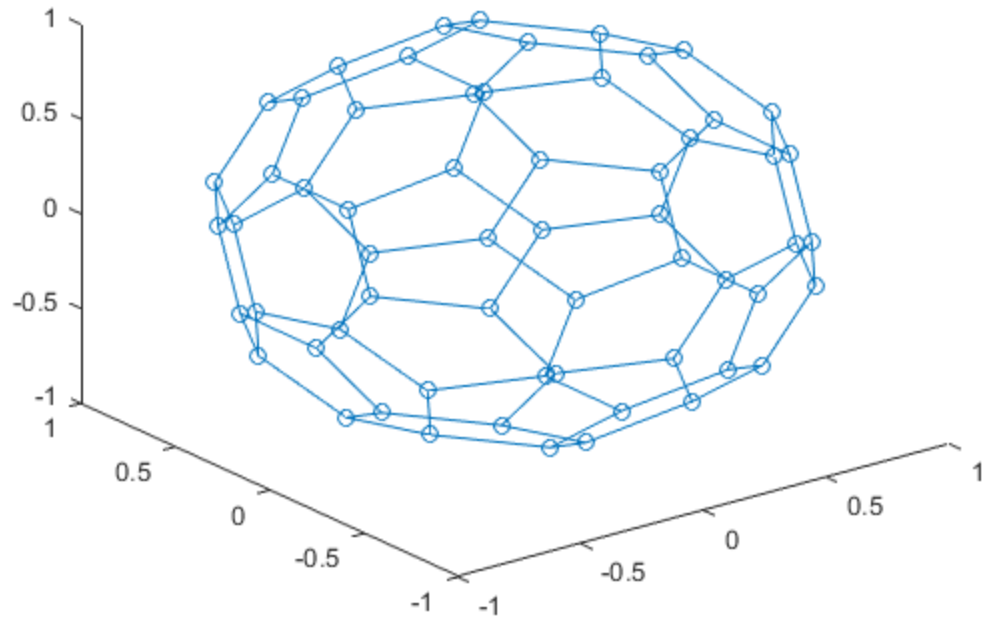
```
H4=zeros(size(x,1),1);  
H4(size(x,1),1)=0.01;  
O14=X.*H4;  
figure;  
subplot(2,2,1);  
plot(H4);  
subplot(2,2,2);  
plot(O14);  
O24=X1.*H4;  
subplot(2,2,3);  
plot(H4);  
subplot(2,2,4);  
plot(O24);
```



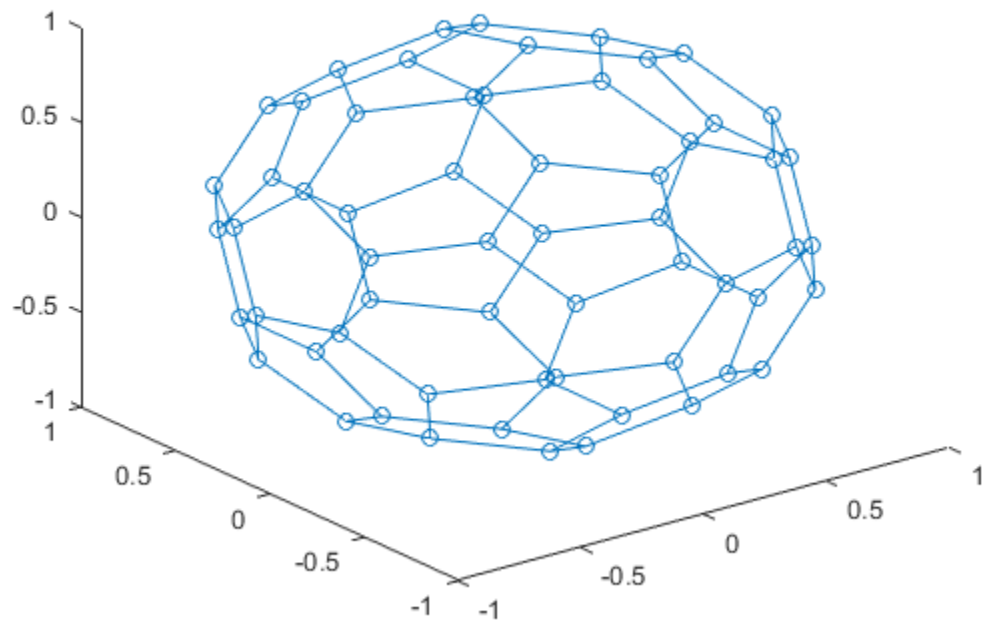
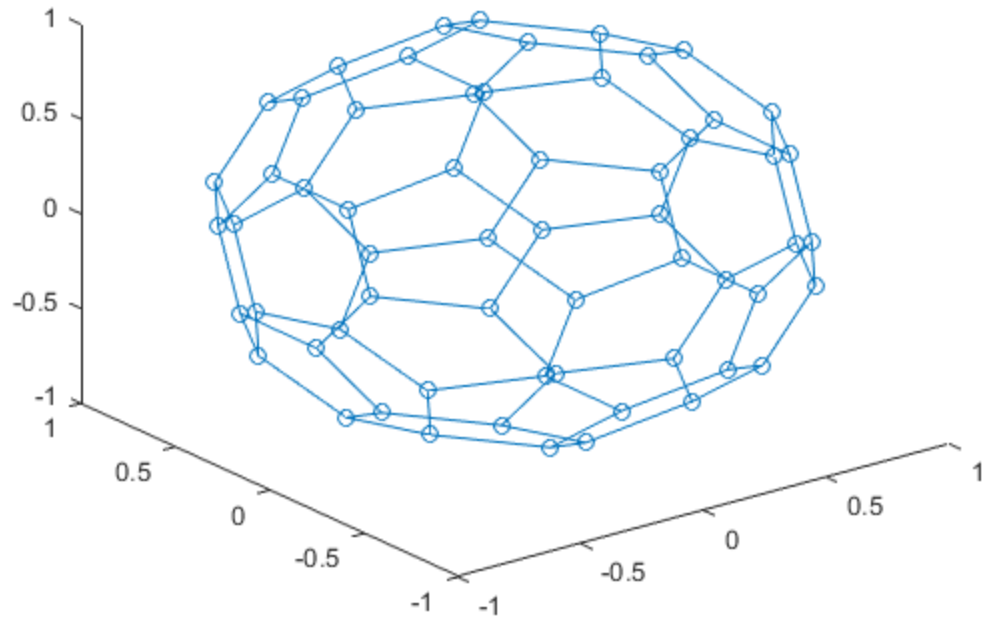
**plot the outputs of ( 4,5,6) on Bucky ball graph**

```
my3dgplot(Bu,O12,XY);  
my3dgplot(Bu,O22,XY);  
my3dgplot(Bu,O13,XY);  
my3dgplot(Bu,O23,XY);  
my3dgplot(Bu,O14,XY);  
my3dgplot(Bu,O24,XY);
```









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