**Question 1**

Your dog fluffy swallowed a marble. The vet suspects that it has now worked its way into the intestines. Using ultrasound, data is obtained concerning the spatial variations in a small area of the intestines where the marble is suspected to be. Unfortunately, fluffy keeps moving and the internal fluid movement through the intestines generates highly noisy data. 

Do you want your dog to live? In order to save your dog's life you must located and compute the trajectory of the marble. Download the following:**Testdata.mat**.

Link to web hosted file: [**Testdata.mat**](http://courses.washington.edu/amath582/Testdata.mat)

This contains 20 rows of data for 20 different measurements that were taken in time.

1) Through averaging of the spectrum, determine the frequency signature (center frequency) generated by the marble.

2) Filter the data around the center frequency determined above in order to denoise the data and determine the path of the marble. (use plot3 to plot the path once you have it)

3) QUESTION: Where should an intense acoustic wave be focused to breakup the marble at the 20th data measurement.

Good luck, and I hope your dog doesn't die.

The following code will help you get started in analyzing the data. It also tells you the spatial and spectral resolution of your ultrasound equipment. (NOTE: the reason for the {**close all** command before **isosurface**is that **isosurface**doesn't seem to clear the previous imagine before plotting a new one)

clear all; close all; clc;   
load Testdata

L=15; % spatial domain   
n=64; % Fourier modes   
x2=linspace(-L,L,n+1); x=x2(1:n); y=x; z=x;   
k=(2\*pi/(2\*L))\*[0:(n/2-1) -n/2:-1]; ks=fftshift(k);

[X,Y,Z]=meshgrid(x,y,z);   
[Kx,Ky,Kz]=meshgrid(ks,ks,ks);

for j=1:20   
Un(:,:,:)=reshape(Undata(j,:),n,n,n);   
close all, isosurface(X,Y,Z,abs(Un),0.4)   
axis([-20 20 -20 20 -20 20]), grid on, drawnow   
pause(1)   
end

Determine solutions for (X,Y,Z) and provide your answers below.

Only answers within + or - 0.5 or the correct answer will be accepted.

**Provide your solution for X below**   
All answers should be to the tenth. For example: **-7.3**Do not include spaces before or after your answer.

**Question 2**

**Question 1 restated: Provide your solution for Y below**Your dog fluffy swallowed a marble. The vet suspects that it has now worked its way into the intestines. Using ultrasound, data is obtained concerning the spatial variations in a small area of the intestines where the marble is suspected to be. Unfortunately, fluffy keeps moving and the internal fluid movement through the intestines generates highly noisy data. 

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close all, isosurface(X,Y,Z,abs(Un),0.4)   
axis([-20 20 -20 20 -20 20]), grid on, drawnow   
pause(1)   
end

Determine solutions for (X,Y,Z) and provide your answers below.

Only answers within + or - 0.5 or the correct answer will be accepted.

**Provide your solution for Y below**

Answer for Question 2



**Question 3**

**Question 1 restated: Provide your solution for Z below**You dog fluffy swallowed a marble. The vet suspects that it has now worked its way into the intestines. Using ultrasound, data is obtained concerning the spatial variations in a small area of the intestines where the marble is suspected to be. Unfortunately, fluffy keeps moving and the internal fluid movement through the intestines generates highly noisy data. 

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2) Filter the data around the center frequency determined above in order to denoise the data and determine the path of the marble. (use plot3 to plot the path once you have it)

3) QUESTION: Where should an intense acoustic wave be focused to breakup the marble at the 20th data measurement.

Good luck, and I hope your dog doesn't die.

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[Kx,Ky,Kz]=meshgrid(ks,ks,ks);

for j=1:20   
Un(:,:,:)=reshape(Undata(j,:),n,n,n);   
close all, isosurface(X,Y,Z,abs(Un),0.4)   
axis([-20 20 -20 20 -20 20]), grid on, drawnow   
pause(1)   
end

Determine solutions for (X,Y,Z) and provide your answers below.

Only answers within + or - 0.5 or the correct answer will be accepted.

**Provide your solution for Z below**