1   Instructions

Please save your code for the following exercises to an m-file and send it to me via email (`suadusum@ucsd.edu`). To help you download a file called `lab2start.m` (`http://topex.ucsd.edu/rs/lab2/lab2start.m`). This file has a few lines of code to get you started.

2   Exercises

1) Create a sine (or cosine) function 2048 points long with exactly 32 or 64 full cycles over this interval. Plot this function and label the axes. (You might recognize this part from Lab 1.)

2) Take the Fourier transform of the function that you made in Exercise 1 using the `fft()` function in Matlab. Plot the real and imaginary parts of the transform versus wavenumber. Take the inverse Fourier transform of your series. Do you get what you started with? What happens if you use an even function instead of an odd one (or vice versa)? Label all your plots.

Helpful Hint: There is a function `fftshift()` that will shift the zero wavenumber to the center of the plot. If there are nx points in your series, then the wavenumber should be `k = -nx/2:nx/2-1`.

Listing 1: Example of `fft()` and `fftshift()`

```matlab
% generate the wavenumbers
k=-nx/2:nx/2-1;
% take the Fourier transform then shift wavenumbers
cy=fftshift(fft(y));
```

3) Using Matlab functions to create a 2-D array of numbers 400×300. Make it something interesting. Use the `meshgrid()` function to create the inputs. Make an image of this function using `imagesc()` in greyscale. Supply a colorbar and label the x- and y-axes. Change the value of the array elements 100:110, 50:60 to make something that will be visible in the image. Is the spot in the correct location? If not try the command `flipud()`.

4) Generate an array of numbers 1024×1024 containing zeros. Imbed a rectangular patch of ones in the array of zeros. We'll call this the aperture. Take the Fourier transform and look at the amplitude (angular resolution of aperture). How does the angular resolution change as the size and shape of the aperture are changed?

5) Create your own aperture and look at its Fourier transform. Be creative! We'll show the results in class and vote on the most unusual aperture.