1 Instructions

Please submit your programming solutions to the lab exercises as scripts attached to an e-mail addressed to esg006@ucsd.edu. In MATLAB, a script is also referred to as an m − file. For novice users, there is some further discussion below about saving your working code in this format.

Ideally, the subject line of your e-mail should start with SIO135/SIO236 and contain the lab exercise number. Give your m − file attachment a file name containing your last name, first name, and the lab number as follows: lastname_firstname_lab#.m

If you are not yet familiar with working in MATLAB, please proceed to Section 2 (Getting Started with MATLAB), and accomplish the exercises there. On the other hand, students who only need to review their previous knowledge of it should just submit their solution for the exercise in Section 3 (MATLAB Review).

2 Getting Started with MATLAB

MATLAB and similar software suites such as Octave provide a set of built-in functions for working with and performing operations on matrices and vectors. A good tutorial for beginners may be found at the following website: `http://www.math.utah.edu/lab/ms/matlab/matlab.html`

Another suggestion to help improve your MATLAB skills is to browse through the Demos section in the MATLAB Help menu. Also, be aware that apart from using the Help index to find out more about the usage of a particular function (such as imagesc), it is possible to type help imagesc at the command prompt as well.

Often, solving a problem would involve running a sequence of MATLAB commands. When these consecutive lines of commands are saved as a plain text file, this is called a script, and specifically in MATLAB it is an m − file. A script with the file name mfile_example.m can be called from the MATLAB command window by simply typing mfile_example. This executes the script, and this is equivalent to having run the commands one after another by entering them in the command window. You can make and edit an m − file using MATLAB's built-in editor, but any plain text editor will do. Below is an example of an m − file:

Listing 1: Sample contents of an m-file

```
% SIO 135/236 Lab 1

% Example Exercise # 1
x = [0:1:2048]
% (other commands follow)

pause

% Example

pause
```

Notice the pause commands separating the lines of MATLAB code pertaining to different exercises for the same lab assignment. This allows for the execution of one section of your m − file at a time. It is recommended that you follow this format when you save your work as an m − file for these lab exercises:

2.1 Exercise 1

Use your own computer or login to a computer in an ACMS lab using your regular UCSD username and password. If you've never used MATLAB before, look at a demo or a tutorial website (see above). Use an m − file to save your work, and make sure you save it in a place you can find it again (e.g., your Desktop).

2.2 Exercise 2

Write a short program to generate a sine (or cosine) function 2048 points long. Generate exactly 32 or 64 full cycles over this interval. Plot the results and add labels to the axes.

2.3 Exercise 3

Create two 6x6 matrices, A and B, of any numbers or function you like. Multiply A and B using matrix multiplication. Multiply corresponding elements of A and B. Plot both results using imagesc and add a colorbar. Change one plot to grayscale using colormap.

3 MATLAB Review

3.1 Exercise

The class notes on platforms and orbits include the following formulas for calculating a ground track for a satellite in a circular orbit about a spherical earth (don't worry about converting from geocentric to geodetic coordinates). Use this formula to calculate and plot the ground track of any remote sensing satellite. The following parameters will produce an exact 10-day repeat track for the Topex satellite.

$$\omega_e = 2\pi/86164.1 \tag{1}$$

$$\omega_s = 2\pi/6745.72 \tag{2}$$

$$\omega_n = \omega_e - \omega_s \frac{10}{127} \tag{3}$$

$$\omega_e' = \omega_e - \omega_n \tag{4}$$

$$i = 66.01 \frac{\pi}{180} \tag{5}$$

$$\theta(t) = \sin^{-1}[\sin(\omega_s t) sin(i)] \tag{6}$$

$$t(\theta) = \omega_s^{-1} \sin^{-1}\left[\frac{\sin(\theta)}{\sin(i)}\right] \tag{7}$$

$$\phi(t) = \tan^{-1}\left[\frac{-\sin(\omega_e' t)\cos(\omega_s t) + \cos(\omega_e' t)\sin(\omega_s t)\cos(i)}{\cos(\omega_e' t)\cos(\omega_s t) + \sin(\omega_e' t)\sin(\omega_s t)\cos(i)}\right] + \phi_0 \tag{8}$$

The following website lists orbital parameters for various satellites: `http://www.n2yo.com/`