Exercises for Day 17

Today we will be spending the whole class period working on a coding exercise that combines various topics we have covered in the past 17 lectures.

Exercise 1. Download the Excel spreadsheet named `turb_jet.xls` from the course web page. This data file contains the velocity measurements taken at the edge of a turbulent jet. It has two columns of data. The first column lists the time in seconds while the second column lists the instantaneous jet velocity in m/s. The time data is evenly spaced; the difference between all times is a constant.

Create a script called `lastname_firstname_practice.m` (using your last name and first name). The script should do the following:

a) Read in the data stored in the Excel spreadsheet. Plot the jet velocity in m/s against the time in seconds. Properly label both axes, and provide a meaningful title to the figure.

b) Invoke the MATLAB built-in command `mean` to determine the average velocity value in the data set, in m/s. (**Hint:** You may learn how to use the `mean` command by looking up the documentation.) Have your program print out the average velocity value to a text file named `lastname_firstname_practice.txt` in the following format.

```
The average velocity of the data set is xxx.xx m/s.
```

Notice that you should display 5 significant figures and 2 of them should come after the decimal point.

c) Obtain the velocity fluctuation, u', by subtracting the average velocity from each instantaneous velocity value in the data set. Take the absolute value of the velocity fluctuations. Have your program print out the minimum and the maximum velocity fluctuation magnitude to the same text file. Your results should be displayed in the following format.

```
By magnitude,
the minimum velocity fluctuation is xx.xxxx m/s while
the maximum velocity fluctuation is xxx.xxxx m/s.
```

d) The turbulence intensity is measured by the root-mean-squared value of the velocity fluctuations obtained in Part (c), *i.e.*

$$\text{turbulence intensity} = \sqrt{\frac{\sum_{i=1}^{N} (u')^2}{N}}$$

where u' is the velocity fluctuation in m/s, and N is the total number of velocity data points in the file. Use a `for` loop to compute the turbulence intensity of the velocity data provided. Have your program print out the turbulence intensity of the jet to the same text file in the following format.

```
The turbulence intensity is x.xxxxe+xx m/s.
```

When you complete the exercise, put your `lastname_firstname_practice.m` and `lastname_firstname_practice.txt` files in the Moodle dropbox for your ME 123 section. There is no paper turn-in for this assignment.