csvread to import the data) and import the data. Try and use xlsread, csvread or even importdata and try and see which one works the best for this type of file.

You then must plot the following on separate figures: Altitude (m) vs. Time (hrs), Altitude (m) vs. Temperature (C) and Altitude (m) vs. Pressure (kPa).

Homework

Introduction to fgetl, fopen and fids `https://www.youtube.com/watch?v=L-pBWbNWJtY`

WEEK 3

16.I. Day 1

Your task is to download the pitot_sensor.txt file on Sakai and convert the raw bits to windspeed using the equation found on this website.
`http://cmrelabtutorials.blogspot.com/2016/03/pitot-tube-wiring-diagram-and-data.html`

Once the data is converted plot it as a function of time. If you notice the plot is very noisy. Thus you will need to create a moving average filter using the equation below where u is the unfiltered signal and y is the filtered signal. σ is a filtering parameter that can be anywhere from 0 to 1. Experiment with different weighting values until you get a nice filtered signal.

$$y_{n+1} = \sigma y_n + (1 - \sigma)u_n \tag{1}$$

Homework

Meshing `https://www.youtube.com/watch?v=y6spEVKb0qs`

16.J. Day 2

Your task is to download the aU200M.txt, aV200M.txt and aW200M.txt text files which contain the atmospheric winds of a desert at 200 meters in units of m/s. You must import all of these 2D arrays and plot them using the mesh command. Your x-axis and y-axis will be in units of meters with a grid spacing of 25 m.

I HIGHLY RECOMMEND STARTING TO WORK ON DAY (3,4 and 5)'s Assignment.

16.K. Day 3,4 and 5

Download the Longboard performance sensor file called GPSFRITZ.TXT. This text file has a lot of data in it with multiple sensor inputs. The sensor include a GPS and 3 separate proximity sensors. The file spits out lines of data either from the GPS or the proximity sensor. A line with an "o" on it means that the line of data is a proximity sensor line of code. An example can be found below

o 845 74 5 4

The above line of code signifies that the current time from the Arduino is 845 milliseconds. The next three numbers signify a value of 74 cm from the first proximity sensor, 5 cm from the second proximity sensor and 4 cm from the last proximity sensor. Intermittently in the code will be GPS lines of code. There are two types. The first has the call sign $GPGGA as shown below.

$GPGGA,235951.800,,,,,0,00,,,M,,M,,*79

The second type of GPS data out is $GPRMC as shown below.

$GPRMC,235944.800,V,,,,,0.00,0.00,050180,,,N*44

If you notice though the lines of code above have alot of commas that are repeated. This signifies that the data is incomplete. It means the GPS does not have a fix. GPS requires at least 6 satellites to get a fix. Typically there are about 13 GPS satellites above you at any given time at any point in space so the GPS just needs to make sure it is reading at least 6 of these satellites in order to get a fix and acquire a GPS signal. Once the GPS has a signal the $GPGGA line of data will look like this.

$GPRMC,221930.000,A,3041.5145,N,08810.4885,W,5.44,157.52,120416,,,A*75

The format of the data is like this.

Name of Variable	Example	Explanation
Call Sign	$GPRMC	N/A
Time of Fix	221930.000	Data Received at 22:19:30
Navigation Receiver Warning	A	A=OK, V = warning
Latitude,North/South	3041.5145,N	Sensor currently at 30d 41.5145m N
Longitude,East/West	08810.4885,W	Sensor currently at 88d 10.4885m W
Speed Over Ground, Knots	5.44	Sensor is traveling at 5.44 knots
Current Heading, Degrees	157.52	Sensor is traveling at 157.52 Degrees from True North
Date of Fix	120416	Data was received on the 12th of April 2016
Blank	N/A	N/A
Blank	N/A	N/A
Mandatory Checksum	*75	Ensures that data was received properly

When the GPS sensor has a fix the $GPGGA line of data will look like this.

$GPGGA,221930.000,3041.5145,N,08810.4885,W,1,06,2.38,74.0,M,-26.6,M,,*65

The format of the data is like this.

Name of Variable	Example	Explanation
Call Sign	$GPGGA	Global Positioning System Fix Data
Time of Fix	221930.000	Data Received at 22:19:30
Latitude,North/South	3041.5145,N	Sensor currently at 30d 41.5145m N
Longitude,East/West	08810.4885,W	Sensor currently at 88d 10.4885m W
Fix Quality	1	0=Invalid,1=GPS,2=DGPS
Number of Satellites	06	Sensor has data from six satellites
Horizontal Dilution of Precision (HDOP)	2.38	GPS sensor is only accurate to 2.38 meters
Altitude, M	74.0,M	The sensor is 74 Meters above sea-level
Height of geoid above WGS84,M	-26.6,M	The Earth deviates from a true sphere at this location by -26.6 meters
Blank	N/A	N/A
Mandatory Checksum	*65	Ensures that data was received properly

Your assignment then is to do the following

1. Plot all three proximity sensors on the same figure in different colors. The y-axis will be

distance in centi-meters and the x-axis will be time in milliseconds. Make sure to include a legend.

2. Write the date of when the experiment was performed by looking at the data in the file.

3. Type a GPS coordinate from the data file in Google. Use Google Maps to indicate where the experiment was taken. Take a screenshot of where the experiment was done. Where was the experiment performed?

4. Create a 3-D plot with latitude on the x-axis, longitude on the y-axis and altitude on the z-axis.

5. Create a 3-D plot with latitude on the x-axis, longitude on the y-axis and speed in knots on the z-axis.

6. Plot speed as a function of time

16.L. Bonus Problem 1 - if you have time

This assignment will replace your lowest homework grade. If you have a 100% on all your assignments this will give you an extra homework assignment and only serve to increase your grade.

Create a plot with time on the x-axis and distance traveled on the y-axis using the data from the GPSFRITZ.TXT file.

In order to do this you will first need to convert latitude and longitude to a cartesion coordinate system using the equation below where origin can simply be the first GPS data point. Then you can use the distance formula to compute distance traveled.

$$\begin{aligned} x &= 111120(lat - Origin_x) \\ y &= 111120(lon - Origin_y)cos(Origin_x * \pi/180) \end{aligned} \tag{2}$$

16.M. Bonus Problem 2 - If you have time

This assignment will replace your lowest homework grade. If you have a 100% on all your assignments this will give you an extra homework assignment and only serve to increase your grade.

Download the Iris+.log file. This file has a ton of different sensors. Your task is to read in the file using fopen and fgetl commands and save the IMU and IMU2 sensor information. The IMU data file line has the following structure

IMU, time (ms), p (rad/s), q (rad/s), r (rad/s), ϕ (rad), θ (rad), ψ (rad)

Your task is to read in both IMU and IMU2 and make 6 figures (1 for each column of data). The x-axis for each one will be time in milliseconds but the y-axis will be the 6 values of IMU data.

17. Disclaimer

Not all classes progress at the same rate thus course requirements might have to be modified as circumstances dictate. You will be given written notice if the course requirements need to be changed.