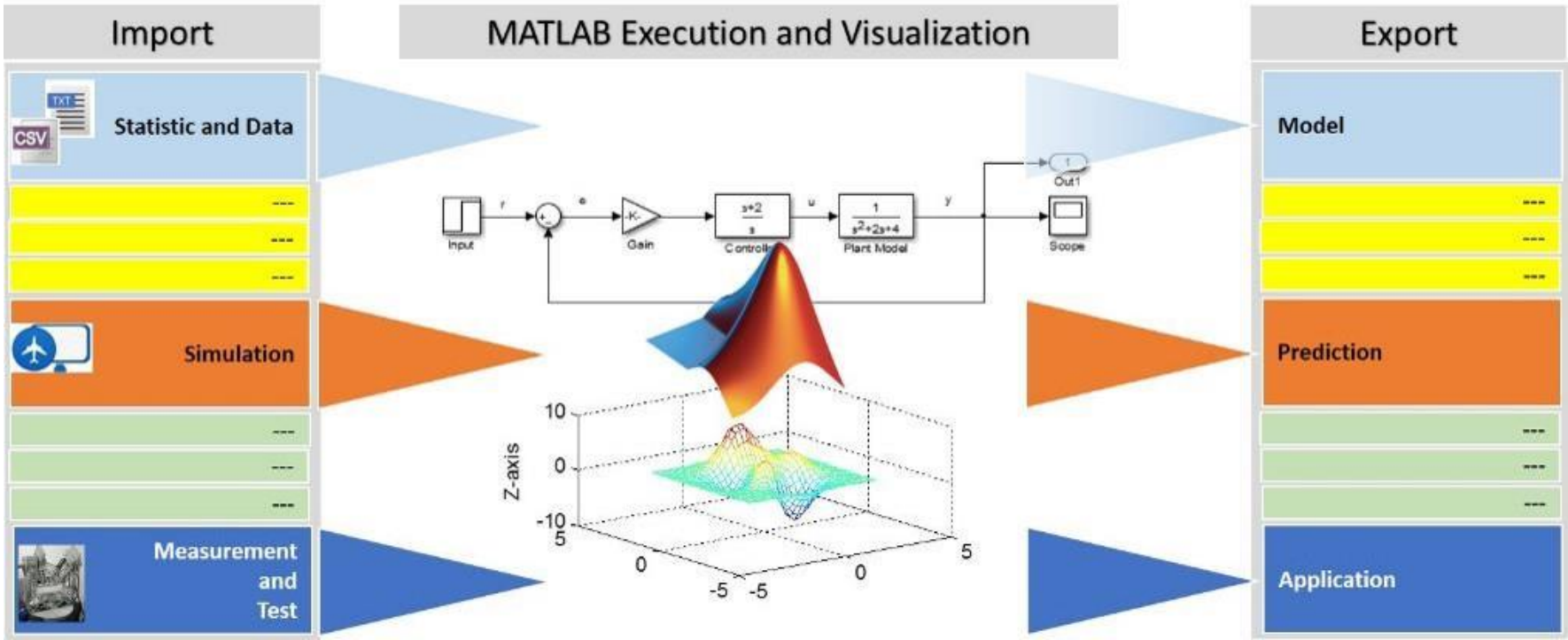

Chapter 4
MATLAB Data Handling and Visualization
- Exercises -

Exercise 1 - Plot GPS Data

1. Given GPS data recorder of a UAV in ***text format***. Find the range of this flying UAV and ***plot*** the flight trajectory (latitude, longitude, and altitude).

Steps to do:

a) Read text file.
b) Parse or split the data to grab your chosen data.
c) Calculate the distance between waypoints.
d) Plot the results in 2D and 3D graphs.

Hints:

- GPS data format, see: http://www.gpsinformation.org/dale/nmea.htm
- Use Haversine formula to calculate the distance between waypoints: http://www.movable-type.co.uk/scripts/latlong.html

GPS Data:

grabedit2.m | GPS24282.m | Xgps24282.TXT

```
$LSD1,000600,0739.7157,S,10741.5808,E,1,10,0.7,36.5,M,0.9,M,,*59
$LSD1,000601,0739.7158,S,10741.5808,E,1,10,0.7,36.5,M,0.9,M,,*57
$LSD1,000602,0739.7158,S,10741.5808,E,1,10,0.7,36.4,M,0.9,M,,*55
$LSD1,000603,0739.7783,S,10741.5686,E,9,10,1.4,38.0,M,0.9,M,,*54
$LSD1,000605,0739.8220,S,10741.5743,E,0,10,0,7,671.5,M,0.9,*63
$LSD1,000606,0739.9135,S,10741.5760,E,0,10,0.7,815.4,M,0.9,M,,*67
$LSD1,000607,0739.9910,S,10741.5770,E,0,10,0.7,1244.3,M,,M,,*54
```

Information

Information

GPS data format: http://www.gpsinformation.org/dale/nmea.htm

For this exercise, we use $GPGGA as GPS data format

$GPGGA,000600, 0739.7157,S, 10741.5808,E,1,10,0.7,36.5,M,0.9,M,,*59

where:

- GGA — Global Positioning System Fix Data
- 000600 — Counter / Time 600
- 0739.7157,S — Latitude 07 deg 39.7157' S [format: “degree/minute“]
- 10741.5808,E — Longitude 107 deg 41.5808' E [format: “degree/minute“]
- 1 — Fix quality: 0 = invalid; 1, 2, 3 = GPS fix (SPS), DGPS fix, PPS fix
- 10 — Number of satellites being tracked
- 0.7 — Horizontal dilution of position
- 36.5,M — Altitude, Meters, above mean sea level
- 0.9,M — Height of geoid (mean sea level) above WGS84 ellipsoid
- (empty field) — Time in seconds since last DGPS update
- (empty field) — DGPS station ID number
- *59 — The checksum data, always begins with *

Information

Information

Haversine Formula: http://www.movable-type.co.uk/scripts/latlong.html

We use *Haversine Formula* to calculate the distance between two points on the earth

- $$d = 2r \arctan\left(\sqrt{\frac{\sin^2\left(\frac{\phi_2-\phi_1}{2}\right)+\cos(\phi_1)\cos(\phi_2)\sin^2\left(\frac{\lambda_2-\lambda_1}{2}\right)}{1-\sin^2\left(\frac{\phi_2-\phi_1}{2}\right)+\cos(\phi_1)\cos(\phi_2)\sin^2\left(\frac{\lambda_2-\lambda_1}{2}\right)}}\right)$$
- with,
  - d is the distance between two points on earth
  - r is radius of the earth
  - ϕ_1, ϕ_2 are latitude of position 1 and position 2
  - λ_1, λ_2 are longitude of position 1 and position 2

- **Note:**
  1. The latitude and longitude must be in *decimal degree* format
  2. The angle in haversine formula should be in *radian*

Exercise 2 - Import and Export Data

2. Given aerodynamics data in several files using text format, do the following:
   i. Extract the hinge moment data from each file (this is the only data in the given files).
   ii. Export all data to a single excel file, such that the data is represented as a table (i.e., the columns holding the data lie next to each other).

Steps to do:

a) Determine several *.txt files in a folder.
b) Open and read the data inside each *.txt file.
c) Import the chosen data into MATLAB workspace.
d) Export the data to a single excel file as a table.

Exercise 3 - GUI

3. Create a GUI from *Exercise 1*, and display the following data:
    i. 3D graphical plot of flight trajectory.
    ii. GPS data.
    iii. Updated distance.

Steps to do:

a) Create GUI.
b) Use appropriate component palette to display your data.
c) Adapt your function in Exercise 1 to this exercise (use callback in MATLAB editor).