CE-676A – Laboratory 2
(2022-23-II Semester)

Using Limulator for LiDAR data generation and understanding

Objective

Generating LiDAR data using Limulator and understanding the effect of flight parameters

Methodology

1. Download Limulator from http://home.iitk.ac.in/~blohani/Limulator/Lim_index.html. You have already downloaded so you can skip this step.
2. Read about Limulator from the literature provided on the help with the program and the above site.
3. Create a terrain of 200 m by 300 m with four buildings of sizes 20m by 30m with different orientation. The general steps are:
    i. Click 'City Model' button, it will open a window
    ii. Click on 'Raster' and choose 'Surface type'. You can define either complex or simple terrain. Choose Simple terrain with default values and click ok
    iii. Click Draw Area button and enclose draw area of interest i.e 200 m by 300 m area.
    iv. Click objects (Building) icons and give elevation value. You can resize the shape of buildings.
    v. Under the 'Raster' option, click 'Generate Raster' and choose the path where you want to save the file. Click OK.
    vi. Click on 'sensor' button, it will open a window. Under the sensor types, choose 'Generic Sensor'. Define parameters accordingly as given in step 5. Click Ok button.
    vii. Go back to 'City Model' window. Choose flight line direction. You can either choose 'Optimal flight line' or you can define manually by drawing the direction.
    viii. Under the raster, click on 'Area Reader' and load the .area file.
    ix. Under the raster, click on 'Raster Reader'.
    x. You can add Roll, Pitch, Yaw simulation and error in range by clicking on the particular options shown in the toolbar.

xi. Save the simulated point cloud in .las format. Click on 'Output' and different options will be open. Choose .las to save it in las format. You can choose multiple options also. Give the path and file name. Click OK.

4. The terrain generated above will be used for creating different kinds of LiDAR data.
5. Generate LiDAR data for the above terrain for the following specifications and store as a LAS file:
   a. Height = 500m
   b. Scan angle = 22.60 degrees
   c. PRF = 10,000
   d. Scan frequency = 20 per second
   e. Velocity = 60 m per second
   f. Flight along length of terrain
   g. No error
   h. No change in 6 DoF with flight
6. The above data is a reference data that will be used for comparison purpose.
7. Now generate data with changing the parameters as follows. Keep all other parameters same as in case of reference data generated above:
   a. Change PRF to 20,000
   b. Change Scan frequency to 40 per second
   c. Change velocity to 30 m per second
   d. Change Flight direction in the direction of width of terrain
   e. Add random error in complete data as (in X and Y direction +-30cm and in Z +-15 cm)
   f. Add error in scan angle measurement by 2 degrees
   g. Add error in Range measurement by 10 cm
8. Generate the above data sets and save as LAS files.
9. Take all data to FugroViewer or QTViewer and load the reference data and each of these data with changed parameters individually for comparison purpose. Observe the effect of change of parameter and corroborate with physical interpretation that why the change has occurred.

Report

Write in your report:

1. The changes observed in the data created with changed parameters from that of the reference data.
2. Your feedback about the Limulator and possible improvements in this.
3. Physical interpretation that why the change has occurred the way it appears in each case. You already know the role of flight parameters.