Development of airborne altimetric LiDAR simulator and its evaluation

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Abstract
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A simulator for airborne altimetric LiDAR has been developed. This simulator aims at emulating the functioning of actual LiDAR sensors which are available in market or of a generic sensor where parameters can be specified without any constraints as in case of former. The simulator begins with creating terrains which are modeled using raster or mathematical functions. The GUI permits a user to generate varieties of terrains with over ground objects which include buildings, trees, hedges, roads etc. The flight path can be simulated so as to match the 6 degrees of freedom of a normal flight. Scanning and laser pulse firing mechanisms of sensors are modeled using appropriate mathematical models. The simulator generates LiDAR ground point by solving the intersection of laser vector originating from laser head with the terrain. All data input and output are facilitated using a GUI. Further, there is scope to add errors at various steps of data generation and observe their effect on final data. The simulator being presented in this paper is in its final form and ready to be distributed. The simulator can prove an ideal tool for research, teaching and in commercial flight planning.

The aim of this paper is to discuss the development of simulator and more specifically carry out a study of the data/results generated by the simulator. The results are generated to show the functionality and efficiency of the simulator and to validate its performance.

Functions

- Six degrees of freedom of trajectory
- Acceleration and attitude simulation
- Scan pattern simulation
- Laser vector intersection
- Terrain used for simulation
- LiDAR data without error
- LiDAR data with error
- LiDAR data for fractal terrain
- Profile A-A without error
- Profile A-A with error
- Profile B-B w. r. t. flight lines

Tools used
- JAVA SDK
- OOSE

Simulate=520m
Overlap10%
Velocity=60m/s
Sensor-ALS-50
Firing frequency=40KHz
Scan frequency=48Hz
Scan angle=40°
Flight area=500m×400m