Automating the Calibration of Airborne Multisensor Imaging Systems

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Key words:

ABSTRACT

To fully exploit the potential of LIDAR technology and to consequently achieve maximum accuracy of the laser points on the ground, the entire multi-sensory measurement system should be carefully calibrated. The overall system calibration is a very complex task and includes individual sensor calibration as well as the determination of the sensors' spatial relationships. High-performance integrated GPS/INS systems provide the navigation data for the LIDAR data acquisition platform, and thus, the quality of the navigation solution is the primarily determinant of the possible accuracy of the laser spots. To achieve or approach the performance level of the navigation, however, the spatial relationship between the navigation sensor and the laser scanner, called the mounting bias or boresight, must be known with high accuracy.

This paper deals with a specific subtask of the overall system calibration process – finding the boresight misalignment of LIDAR systems. There are a few methods for obtaining the boresight misalignment, which normally refers only to the determination of the rotation angles between the INS and laser scanner systems. The most common method is a simple trial and error approach, where the operator interactively changes the angles to reach some fit of the LIDAR spots with respect to some known surface. A more advanced but still human-based technique uses block adjustment with control points. Since the ground surfaces are not always known or not at the required accuracy level, preference is given to techniques which do not require a priori knowledge of the surface. In this paper we propose an automatic boresight determination method that does not require any ground control and is based on using two/three or more overlapping LIDAR strips flown in different directions. The surface differences from the different strips over the same area are considered as observations and an adjustment is formulated to determine the boresight misalignment angles.

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