SELF-CALIBRATION AND EVALUATION OF THE TRIMBLE GX TERRESTRIAL LASER SCANNER

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ABSTRACT:

In this project, the point-based self-calibration approach described in Lichti (2007) was used to identify and model systematic errors in the Trimble GX terrestrial laser scanner. The GX was calibrated twice, the first calibration took place in a large 14 m by 11 m by 3 m classroom with 150 non-standard circular planar paper targets where 6 scans were captured, the second calibration happened the following day in a smaller 5 m by 5 m by 3 m room with 300 circular planar paper targets where 4 scans were captured. The centroid of all targets was measured in every point cloud using a combination of least-squares plane fitting and circle fitting. Since exact point-to-point correspondence exists, the targets from different scans were related mathematically by a 3D rigid body transformation. The modelling of systematic errors was performed in the spherical coordinate system, which is the coordinate system where the terrestrial laser scanner make its raw observations. From the self-calibration, a range finder offset of 3.7 mm was determined for the scanner and target combination. There appears to be a -45 arcseconds vertical circle index error. The GX also exhibits signs of significant horizontal encoder eccentricity and was modelled as a sine and cosine function with an amplitude of 14 and 20 arcseconds, respectively. After modelling the three systematic errors the RMS in range, horizontal circle reading, and vertical circle reading for the GX was improved by 14, 3, and 4 percent, respectively.

TOPIC: Lidar and laser scanning
ALTERNATIVE TOPIC: Physical modeling and signatures