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RIGOROUS POINT-TO-PLANE REGISTRATION OF TERRESTRIAL LASER SCANS

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Abstract. Terrestrial laser scanning data that are acquired from multiple scan locations need to be registered before any 3D modeling and/or analysis is conducted. This paper presents a rigorous point-to-plane registration approach that minimizes the distances between two overlapping laser scans, using the General Least Squares adjustment model. The proposed approach falls under the class of fine registration and does not require any targets or tie points. Given some initial registration parameters, the proposed approach utilizes the scanned points and estimated planar features on both scans to determine the optimum parameters in the least squares sense. Both the uncertainty of the points due to the incidence angle, and the uncertainty of the local normal vectors of the planar features are taken into account in the stochastic model of the adjustment. The impact that these considerations with the stochastic model have on the registration is then demonstrated with comparisons on real terrestrial laser scanning data, and on smaller simulated data.

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