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GENERAL MATHEMATICAL MODEL OF LEAST SQUARES 3D SURFACE MATCHING AND ITS APPLICATION OF STRIP ADJUSTMENT

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Abstract. Systematic errors in point clouds acquired by airborne laser scanners, photogrammetric methods or other 3D measurement techniques need to be estimated and removed by adjustment procedures. The proposed method estimates the transformation parameters between reference surface and registration surface using a mathematical adjustment model. 3D surface matching is an extension of 2D least squares image matching. The estimation model is a typical Gauss-Markoff model and the goal is minimizing the sum of squares of the Euclidean distances between the contiguous surfaces. Besides the generic mathematical model, we also propose a concept of conjugate points rules which are suitable for special registering applications, and compare it to three typical conjugate points rules. Finally, we explain how this method can be used for the co-registration of real 3D point sets and show co-registration results based on airborne laser scanner data. Concluding results of our experiment suggest that the proposed method has a good performance of 3D surface matching, and the least normal distance rule returns the best result for the strip adjustment of airborne laser altimetry data.

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