Investigation of space-continuous deformation from point clouds of structured surfaces

Elisabeth Ötsch[1], Corinna Harmening[2], Hans Neuner[1]

[1] Department of Geodesy and Geoinformation, TU Wien, Wiedner Hauptstraße 8-10, 1040 Wien, Austria, (elisabeth.oetsch@tuwien.ac.at; hans.neuner@tuwien.ac.at)
[2] Geodetic Institute, Karlsruhe Institute of Technology, Engelerstraße 7, 76131 Karlsruhe, Germany, (corinna.harmening@kit.edu)

Key words: *B-spline surfaces; terrestrial laser scanning; segmentation; space-continuous deformation analysis; congruence model; parameter-based point cloud comparison; modelling of structured surfaces*

ABSTRACT

One approach to estimate space-continuous deformation from point clouds is the parameter-based epochal comparison of approximating surfaces. This procedure allows a statistical assessment of the estimated deformations. Typically, holistic geometric models approximate the scanned surfaces. Regarding this, the question arises on how discontinuities of the object's surface resulting from *e.g.* single bricks or concrete blocks, influence the parameters of the approximated continuous surfaces and in further consequence the derived deformation. This issue is tackled in the following paper. B-spline surfaces are used to approximate the scanned point clouds. The approximation implies solving a Gauss-Markov-Model, thus allowing accounting for the measurement's stochastic properties as well as propagating them on the surface' control points. A parametric comparison of two B-spline surfaces can be made on the basis of these estimated control points if common parameterization of the observations is applied. This approach is advantageous with regard to the transition of the space-continuous deformation analysis to a point-based task, thus ensuring the applicability of the well-established congruence model. The influence of the structure's geometry on the surface' control points is investigated using terrestrial laser scans of a clinker façade. Points measured in the joints are eliminated using an own developed segmentation approach. This is based on a region-growing solution, which is optimized by adding preliminary information about the dimensions and orientation of individual bricks. A comparison of the results obtained from segmented as well as from unsegmented laser scans for the B-spline approximation and the subsequent deformation analysis provides information about the structure-related influence. An aqueduct arc is used as measuring object in this study. For the intended comparison, data sets, which contain possible influences due to changes of the mechanical loads, are analysed.

This contribution was selected by the Scientific Committee for publication as an extended paper in the Journal of Applied Geodesy https://www.degruyter.com/journal/key/jag/html