Terrestrial Laserscanning - Modeling of Correlations and Surface Deformations

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SUMMARY

Terrestrial Laserscanning offers new possibilities to engineering geodesy in general and deformation analysis especially. Huge amount of measured points lead to different modelling and analysis approaches. Within the project “Integrated spatio-temporal modelling using correlated observations for the derivation of surveying configurations and description of deformation processes” (IMKAD) modeling of correlations and surfaces will be treated among others.

The modelling of correlations within laser scanning point clouds can be realized by using synthetic covariance matrices. These are based on the elementary error model that consists of non-correlating, functional correlating and stochastic correlating error groups. This elementary error model will be applied on terrestrial laser scanning by defining three groups of error sources: instrumental, atmospheric and object based. All the errors have to be classified and modelled according to the model of elementary errors. This contribution presents first simulation results for the Leica HDS 7000 measuring on a small test piece made of gypsum, aluminum and rusty steel. The determined variances and the spatial correlations of the points are estimated and discussed. Hereby, the mean standard deviation of an individual point within the point cloud is up to 2.5 mm and the mean correlation is about 0.94 neglecting the object based error sources in a first approach.

In the second part of this paper the development of the trend component of a spatiotemporal continuous collocation in order to describe areal deformations is presented. This component is modelled by estimated B-spline surfaces. One parameter of B-Spline surfaces are the number and the position of the control points. Here the determination of the optimal number of control points is regarded as a model selection problem. Two linear model selection criteria – the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) – are investigated, compared and applied to simulated data

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sets.

Additionally the contribution will give an outlook with respect to the combination of the before mentioned stochastic and the deterministic approaches with the aim to detect surface deformations in a stochastically correct way.