

Data evaluation for structural condition assessment using modern technologies

Abstract

Structural assessment is a key element of today's engineering work to ensure structural safety and serviceability. Therefore, inspections in regular time intervals are performed. The result of these inspections, e.g. localization and quantification of structural anomalies, is however subjective, since it depends on the experience of the operating engineer. Recently many new approaches using modern technologies and adjusted algorithms are developed to obtain more objective and reproducible results. At the chair of Modelling and Simulation of Structures the usage of small unmanned aircraft vehicles equipped with high quality cameras (UAS) are of great interest. These image-based inspections produce a high amount of data which needs to be processed automatically such that extracted information can be used for the structural condition assessment. Some of the processing steps, which are of research interest and part of ongoing PhD theses, include:

- Geometry extraction (e.g. cross section geometry or displacement changes with respect to a reference state) of reconstructed, dense 3D point clouds
- Automated linking of inspection data sets using geometric relations as post-processing step for a focused evaluation of detail points
- Identifying mechanical parameters of the structure, such as stiffness reduction due to damages
- Updating numerical models, i.e. finite element models (FEM), and calibrate structural parameters with obtained information

Related projects

Bewertung alternder Infrastrukturbauwerke mit digitalen Technologien (AISTEC)

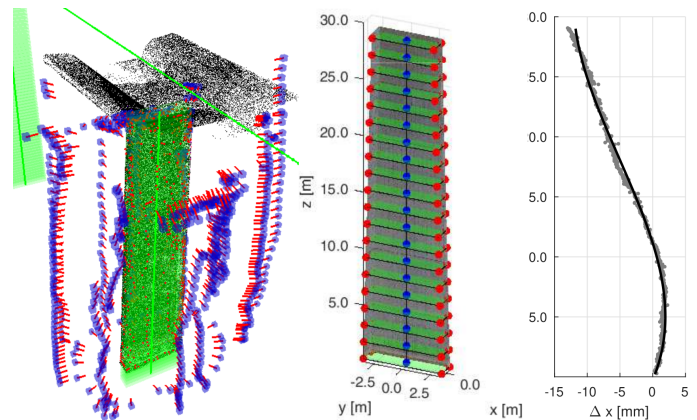
Forschergruppe «Digital Engineering für Planungs- und Revitalisierungsprozesse von Stadtquartieren»

Energetische Quartiersanierung zur Reduktion der CO₂-Emissionen (Bauhaus 2050+)

Collaboration

Bauhaus-Universität Weimar, Professur Computer Vision in Engineering (Prof. Dr.-Ing. Volker Rodehorst)

Bauhaus-Universität Weimar, Virtual Reality and Visualization Research (Prof. Dr. Bernd Fröhlich)



Bridge pier as reconstructed point cloud and camera positions from UAS-based images, superimposed on the FEM geometry (left) for point cloud segmentation (center) and displacement extraction (right)

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Related publications

- [1] MORGENTHAL, Guido ; HALLERMANN, Norman ; KERSTEN, Jens ; TARABEN, Jakob ; DEBUS, Paul ; HELMRICH, Marcel ; RODEHORST, Volker: Framework for automated UAS-based structural condition assessment of bridges. In: *Automation in Construction* 97 (2019), S. 77–95
- [2] TARABEN, Jakob ; HELMRICH, Marcel: Methode zur automatisierten Verortung von Inspektionsdaten aus bildbasierten Bauwerksprüfungen. In: *Forum Bauinformatik 2018, Weimar* (2018)
- [3] TARABEN, Jakob ; BRUST, Paul ; DEBUS, Paul ; MORGENTHAL, Guido ; TAUSCHER, Eike: Approach for the IFC based Integration of Life Cycle Data and Processes in Building Information Models. In: *17th International Conference on Computing in Civil and Building Engineering (ICCCBE), Tampere, Finland* (2018)
- [4] HALLERMANN, Norman ; HELMRICH, Marcel ; MORGENTHAL, Guido ; SCHNITZLER, Elke ; RODEHORST, Volker ; DEBUS, Paul: UAS-basierte Diagnostik von Infrastrukturbauwerken: Teil einer digitalen Instandhaltungsstrategie. In: *Bautechnik* 95 (2018), Nr. 10, S. 720–726