3D Point Cloud Based Spatio-Temporal Monitoring of Artificial and Natural Objects

Corinna Harmening (Austria) and Jens-André Paffenholz (Germany)

Key words: Bridge surveying; Deformation measurement; Engineering survey; Laser scanning

SUMMARY

This paper aims to provide an overview of the field of 3D point cloud based spatio-temporal monitoring. The focus of the paper is on spatio-temporal monitoring of artificial and natural objects with the aid of 3D point clouds acquired by means of multi-sensor-systems (MSS) with a laser scanner as main object capturing sensor.

First, we discuss the technical aspects of the MSS for 3D point cloud acquisition with respect to monitoring applications. In particular, the challenges and chances of the surface-based technique will be outlined. Second, we highlight some experimental results of self-conducted experiments: We focus on loading tests of a historic masonry arch bridge as well as on the evaluation of objects' abstraction for epochal comparison by means of point-wise, area-based and shape-based approaches. For the first showcase, we present results of the load-induced arch displacements on the bridge by means of 3D point clouds acquired by terrestrial laser scanning. In detail, we discuss different approaches for the deformation analysis based on the captured 3D point clouds, i.e. using the Multiscale Model to Model Cloud Comparison (M3C2) algorithm or a parametric procedure by means of B-spline approximation. The second showcase deals with an evaluation of different algorithms for objects' abstractions by means of e.g. B-spline surfaces. For this purpose, 3D point clouds of several natural objects, like plant leaves or soil erosion scenes, are investigated with the aim to obtain measures of interest like overall sizes and volumes.