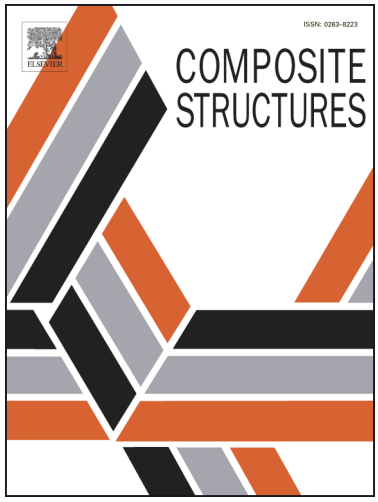

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ABSTRACT

A statical experiment of composite structures based on Terrestrial Laser Scanner (TLS) measurement was conducted to investigate the deformation behavior of arch structure. In this paper, laser scanning measurement data of thirteen epochs are collected and data are extracted and processed with MATLAB. How to improve the reliability of composite structural deformation monitoring is one of the key problems in the field of health monitoring. Comparing with the traditional monitoring methods, TLS monitoring has better flexibility and especially in the actual projects. Because some embedded sensors failed after running several years, other means of structural deformation monitoring are required. The goal of this paper is to investigate the feasibility of TLS technology, which is higher efficiency, accuracy and intelligence, to supplement or substitute the traditional monitoring methodologies.

1. Introduction

The goal of this paper is to investigate the feasibility of TLS technology, which is higher efficiency, accuracy and intelligence, to supplement or even substitute the traditional monitoring methodologies. Terrestrial laser scanning is gaining more and more attention in deformation monitoring because it is relatively fast measuring, with high-accuracy and surface-oriented.

1.1. Surface-based TLS measurements

Recently, TLS has been proved to surpass some traditional measurement manners because it is surface-based measurement and capable for information collection of comprehensive and spacial geometry. [1] used TLS in forest research and management to collect the biomass information of tree canopy size and with a high accuracy, which is not realized with former technologies. Detail information over reach-scale extents can be achieved with TLS measurement in topographic research. Further steps of scanned data will improve the efficiency of the TLS data application, because the TLS data contains information of environment [2].

Generally, TLS scanning obtains 3D coordinates of grid point clouds on object surface and intensity value of the laser beam. Some authors convert point clouds into a mesh or consistent polygonal, such as in [3], in which mesh surface includes edges and faces. Different geometries such as planes, cylinder, B-spline curve and surface are used to approximate the point clouds [4-6]. Boulch etc. [7] presents a new method to describe the point clouds of sharp features. Efforts were also made to improve mathematically the estimation of the approximation parameters based on point cloud data [8-15].

1.2. Deformation Monitoring of Structures

Deformation monitoring is an important topic in a vary of fields like civil engineering and archeology. Many technologies appeared and aided the deformation analysis of objects and structures. Persistent scatterer (PS) point clouds were adopted to monitor the shape and deformation of single buildings from space with high-resolution imagery as well as accurate orbit information [16]. Some researchers studied high-rate carrier phase global positioning system (GPS) receivers in characterizing dynamic oscillations of bridges, which makes verification and improvement of structural design and modeling [17]. Ground-Based Synthetic Aperture Radar Interferometry and Terrestrial Laser Scanning were combined to facilitate the spatial interpretation of displacements affecting archaeological monuments [18]. With permanent scatterer interferometry (PSI) techniques, long term ground deformation in Beijing was investigated [19]. Interferometric synthetic aperture radar data from sensors was successfully used to analyze