8th World Conference on Structural Control and Monitoring (8WCSCM)
Orlando, FL, USA 5-8 June 2022

Target-Free Binocular Vision-Based Method For 3D Vibration Displacement Measurement

Jun LI

This paper proposes a target-free vison-based three-dimensional (3D) vibration displacement measurement approach for civil engineering structures. The state-of-the-art key point detection and matching algorithm based on deep learning techniques is employed to achieve target-free measurement. A phase-based video motion magnification algorithm is further employed to achieve a high measurement accuracy of tiny vibrations at the submillimeter level. The accuracy and performance of the proposed approach are evaluated through experimental tests on a steel cantilever beam in the laboratory. In-field experimental tests are then conducted on a pedestrian bridge on campus to investigate the accuracy of the proposed approach in practical applications. The obtained vibration displacement responses from the proposed approach are compared with those measured by traditional displacement sensors. The results demonstrate that the displacement responses obtained from the proposed approach are accurate compared with the traditional sensors, while the proposed approach is more cost effective to achieve accurate 3D vibration displacement measurement. With the application of motion magnification method, 3D tiny vibration measurements are obtained accurately by the proposed approach.