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Vision-based Input-Output System Identification for Pedestrian Suspension Bridges

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ABSTRACT

Recently, numbers of long span pedestrian suspension bridges have been constructed worldwide. While recent tragedies regarding pedestrian suspension bridges have shown how these bridges can wreak havoc on the society, there are no specific guidelines for construction standards nor safety inspections yet. Therefore, a structural health monitoring system that could help ensure the safety of pedestrian suspension bridges are needed. System identification is one of the popular applications for structural health monitoring method, which estimates the dynamic system. Most of the system identification methods for bridges are currently adapting output-only system identification method, which assumes the dynamic load to be a white noise due to the difficulty of measuring the dynamic load. In the case of pedestrian suspension bridges, the pedestrian load is within specific frequency range, resulting in large errors when using the output-only system identification method. Therefore, this study aims to develop a system identification method for pedestrian suspension bridges considering both input and output of the dynamic system. This study estimates the location and the magnitude of the pedestrian load, as well as the dynamic response of the pedestrian bridges by utilizing artificial intelligence and computer vision techniques. A simulation-based validation test was conducted to verify the performance of the proposed system. The proposed method is expected to improve the accuracy and the efficiency of the current inspection and monitoring systems for pedestrian suspension bridges.

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