

Long Deck Suspension Bridge Monitoring: The Vision System Calibration Problem

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ABSTRACT: Structural Health Monitoring is an emergent powerful diagnostic tool that can be used to identify and to prevent possible failures of the various components that comprise an infrastructure. In the particular case of a suspension bridge, the measurement of the vertical and transversal displacements plays an important role for its safety evaluation. Taking into account the restrictions usually found on these structures, an enhanced solution comprises a non-contact vision-based measurement system with dynamic response, accuracy and amplitude range well suited to the physical phenomenon to measure. The paper describes a methodology to perform the vision system calibration that can be carried out in-situ, while the deck is moving, requiring little effort and a minimum set of information. Specifically, only a set of active targets fixed on the deck and the knowledge about the distances between them is required. Results related to the performance evaluation, obtained by numerical simulation and by real experiments with a reduced structure model, are presented and they show that, even in an environment severely affected by disturbance noise, it is possible to measure the vertical and transversal displacements with a standard accuracy better than 10 mm.

KEY WORDS: long-range photogrammetry, non-contact measurement system, Structural Health Monitoring, suspension bridge, vision metrology