Identifiant de la contribution : **314**   Type : **non spécifié**

"JJCAB3#6 - Video-based vibration analysis of medium and high wood constructions"

lundi 10 juillet 2023 11:45 (5)

With the aim to analyze the vibration of civil and large-scale mechanical structures, video-based displacement measurement has emerged as an attractive technique thanks to its advantages, such as non-contact, full-field measurement, and low interference to occupants. Furthermore, there is a growing demand for wooden buildings since timber is considered a sustainable alternative to concrete and steel. In this context, the thesis focuses on developing a computer vision (CV)-based measurement protocol to measure the vibrations of high-rise timber buildings and large structures. As the first step of this thesis, a video-based displacement measurement using a camera network was conducted on a tower crane. It's because the measurement condition based on the CV for a tower crane is close to that for a high-rise timber building. For CV-based 3D displacement calculation, a procedure is applied that consists of (1) Data acquisition with a camera network, (2) Camera synchronization using a coded light signal that we developed, (3) Camera calibration with two steps, (4) Motion tracking based on Digital Image Correlation (DIC) and Line Segment Tracking that we developed for the robustness, (5) Structural 3D displacement calculation with non-linear triangulation. As a result, 3D displacement of the tower crane was measured based on CV. Furthermore, the 3D displacement results extracted from videos are well-superposed with data acquired by the contact-based sensor (the accelerometer).

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Classification par session :   JJCAB3