The 2022 World Congress on
The 2022 Structures Congress (Structures22)
16-19, August, 2022, GECE, Seoul, Korea

Continuous structural displacement estimation combining accelerometer, vision and infrared cameras

Jaemook Choi[1)], Zhanxiong Ma[2)], and *Hoon Sohn[3)]

[1), 2), 3)] *Department of Civil and Environmental Engineering, KAIST, Daejeon, South Korea*
[1)] cjmook@kaist.ac.kr; [2)] mazhanxiong @kaist.ac.kr; [3)] hoonsohn@kaist.ac.kr

ABSTRACT

With the rapid development of computer vision, vision cameras have been used as noncontact sensors for structural displacement measurement. However, vision-based techniques were limited to short-term displacement measurement, because these techniques have degraded performance with varying illumination and can not operate at night. To overcome these limitations, this study developed a continuous structural displacement estimation method by combining measurements from an accelerometer, vision, and infrared cameras collocated at the displacement estimation point. The proposed method offers the following advantages: (1) continuous displacement estimation for both day-time and night-time, (2) automatic optimization of the temperature range of an infrared camera to ensure a region of interest (ROI) with rich features, and (3) adaptive updating of the reference frame to achieve illumination-robust displacement estimation from vison/IR measurements. The performance of the proposed method was verified by lab-scale tests, and displacements were estimated with less than 2 mm RMSE compared to the lase-based ground truth.

Keywords: Displacement estimation, Infrared camera, vision camera, accelerometer, multi-rate adaptive Kalman filter

---

[1)] Graduate Student
[2)] Graduate Student
[3)] Professor