

Development of a building deterioration monitoring system using a digital image correlation method

(Research period: FY 2019–2020)

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Keywords: Digital image correlation method, deterioration detection, crack, lifted tile

1. Introduction

Digital image correlation (DIC) is an image measurement method that calculates the displacement and distortion of an object from the difference in images taken before and after the formation of the deformation of the object to be measured. In this method, a common way is to apply a random pattern on the surface of an object to ensure measurement accuracy. Yet, it was found that it was possible to detect cracks using DIC by using exterior patterns of a building, such as exterior tiles.¹ This study attempted to develop a lower-cost long-term deterioration monitoring system for buildings by applying two-dimensional DIC that can use monocular camera images.

2. Outline of the long-term deterioration monitoring system with DIC

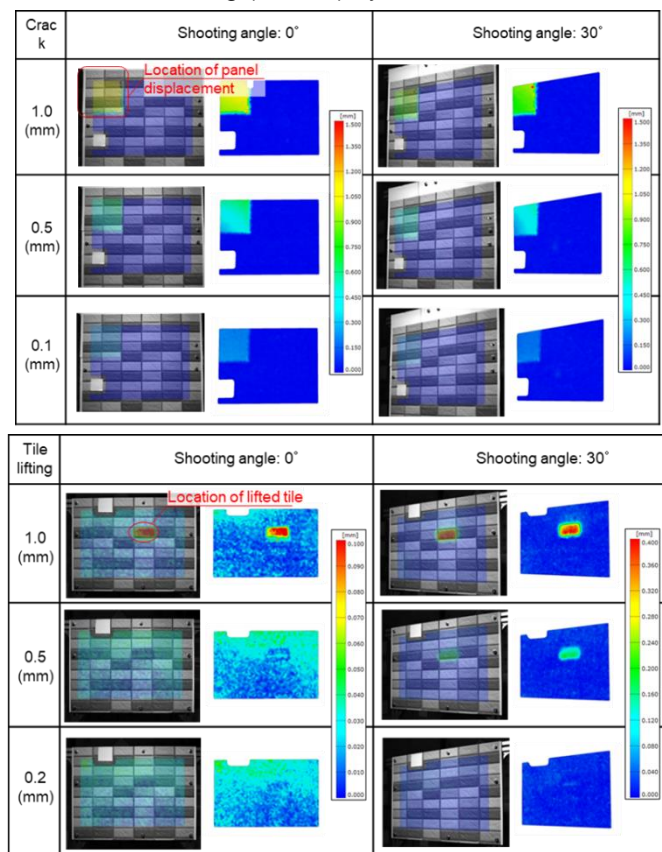
Since two-dimensional DIC requires images of the same position and angle of view taken before and after deterioration, two images taken before and after deterioration were selected for analysis, assuming they were captured continuously with a fixed camera. The camera used in this study had a pixel count of eight megapixels, a shooting distance of one meter, and shooting angles from the front and at 30 degrees.

3. Evaluation by simulated test piece

An example of evaluation results for cracks and tile lifting using simulated test piece is shown below. Cracks are reproduced by cutting and shifting part of the panel. The results show that cracks can be detected down to 0.1 mm and tile lifting down to 0.5 mm when the shooting angle is set to 30°.

In the future, using commercially available security cameras, a system is going to be constructed to send an alert and an image by e-mail when a predetermined threshold of deterioration is exceeded. Also, the

Table: Example of evaluation results of cracks (top) and tile lifting (bottom) by DIC



possibility of actually using such system in the society is going to be explored.

☞ For more information:

- 1) Fundamental experiment on the possibility of the practical use of a damage detection system for buildings using digital image correction method, the Architectural Institute of Japan: Summaries of Technical Papers of Annual Meeting, Information System Technology, pp. 181-182, July 2019
- 2) Fundamental experiment on the possibility of the practical use of a long-term deterioration monitoring system for buildings using digital image correction method (1 and 2), the Architectural Institute of Japan: Summaries of Technical Papers of Annual Meeting, Material Construction, pp. 1037-1040, September 2020