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

Characterization of stacked geotextile tube structure using digital image correlation

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ABSTRACT

Displacement is one of the important elements for evaluating the stability and failure mechanism of hydraulic structures. Digital image correlation (DIC) is a useful technique to measure a three-dimensional displacement field by using two cameras without any contact to the tested material (Chen et al., 2013; Tong and Yoo, 2022) (see Fig. 1(a)). In this study, several geotextile tubes are stacked to build a small-scale temporary dam model to exclude water from a specific area, as shown in Fig. 1(b). The horizontal and vertical displacements of four stacked geotextile tubes are monitored using a dual camera system according to the upstream water level. The geotextile tubes are prepared with two different fill materials. For each dam model, the interface layers between upper and lower geotextile tubes are either unreinforced or reinforced with a cementitious binder. The stacked geotextile tube is measured for displacement analysis, as shown in Fig. 1(c). Experimental results show that as the upstream water level increases, the horizontal and vertical displacements at each layer of geotextile tubes initially increase with the water level, and then remain almost constant until the subsequent water level (see Fig. 2). Thus, the DIC technique suggested in this study may be effectively used to evaluate the displacement distribution of the hydraulic structure, which consists of geotextile tubes.

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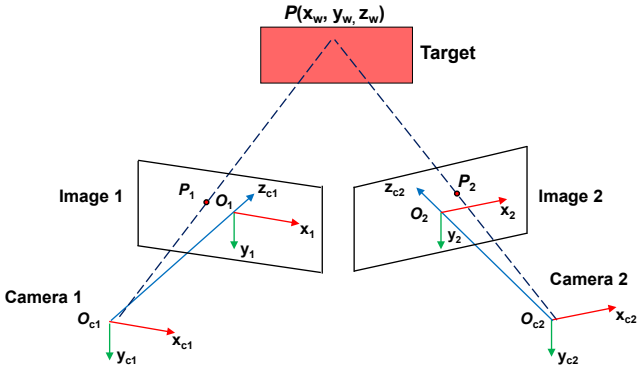
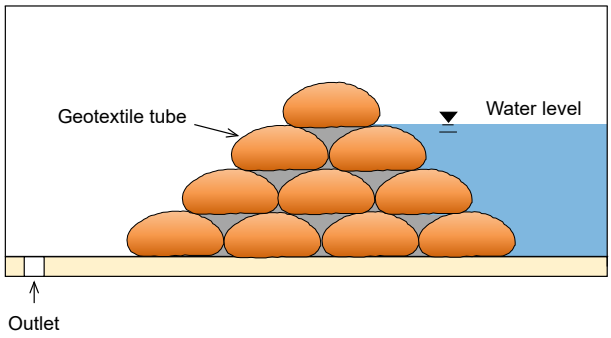


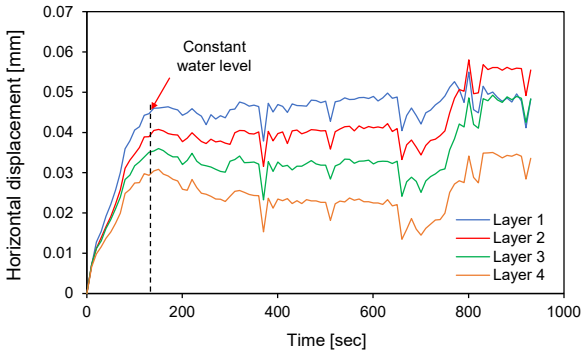
(a) Principle of three-dimensional DIC



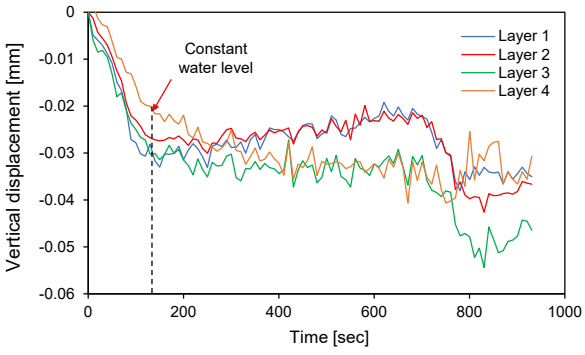
(b) Stacked geotextile tubes

(c) Three-dimensional measurement

Fig. 1 Small-scale stacked geotextile tubes characterized by using DIC



(a) Horizontal displacement



(b) Vertical displacement

Fig. 2 Displacement of stacked geotextile tube

ACKNOWLEDGMENTS

This work was supported by a National Research Foundation of Korea (NRF) grant funded by the Korean government (MSIT) (No. NRF-2021R1A5A1032433).

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