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Centrifuge modeling of geotextile reinforced slopes

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Centrifuge modeling is a powerful tool for physical modeling in geotechnical engineering and offers the advantage to continue the test up to failure. In order to replicate the gravity induced stresses of a prototype structure in a 1/N reduced model, it is necessary to test the model in a gravitational field N times larger than that of prototype structure.
In this paper, a series of model tests in a geotechnical centrifuge on geotextile reinforced slopes is presented. The aim is to identify the possible failure mechanisms. Three reinforced slope models were tested with a slope inclination of 85, 75, and 65 degrees having the same geometry within the model box. The geotextile reinforced slopes had the same height of 200mm and was built on a soil layer of the same properties. Dry sand was used in the tests. Due to the inherent symmetry of the slope about its centerline, only half of the slope was modeled. The model box has the following dimension: 440*155 mm in plan and 400 mm in height with a glass wall on the front side for visualization of the collapse during flight. The model box was subjected to increasing centrifugal acceleration until failure occurred.
Photographs of the geotextile reinforced slope models in flight were taken with a digital camera and the soil deformations of geotextile reinforced slopes were measured with Particle Image Velocimetry (PIV). A small laptop was mounted near the central axis of the centrifuge and connected with the digital camera. Photographs with high resolution were taken in short time intervals through the glass wall during flight. The data were stored in the laptop. The recorded photographs were used to examine the prefailure and post failure mechanism of the reinforced slopes. The experimental results showed that failure occurred due to breakage of the reinforcement in the slopes instead of pullout when intersected by the failure surface.