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# 摘要集

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# Dynamic response characteristics of shaking table model tests on the gabion reinforced retaining wall slope under seismic action

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**Abstract:** In the present study, a series of shaking table model tests were performed on a slope with a gabion reinforced retaining wall. Transfer functions were employed to compute the inherent frequencies of the slope. Furthermore, the investigation examined various aspects of the slope, including the peak acceleration amplification factor, incremental dynamic stresses, displacements, and tensile forces. Additionally, the study employed the Hilbert Huang transform (HHT) to analyze the slope's time-frequency characteristics and energy distribution. The findings of the study revealed that there is an inverse relationship between the amplitude of the input seismic wave and the natural frequency of the top of the gabion reinforced retaining wall slope. As the amplitude of the seismic wave increases, the natural frequency of the slope decreases. The amplification factors for peak acceleration were all found to be less than 1.9, suggesting a notable dissipation of seismic energy in comparison to typical slopes. The response of incremental dynamic stress was most pronounced in the middle section of the slope, followed by the top of the slope. The magnitude of the incremental displacement was found to be highest at layer 4, whereas the incremental tensile force exhibited its maximum value at layer 5. The dynamic response exhibited the least pronounced characteristics at the lower portion of the slope, demonstrating the most stable behavior. The peak frequencies observed in the Hilbert marginal spectrum displayed comparable characteristics to the natural frequencies.

**Keywords:** Shaking table test, Seismic action, Gabion reinforced retaining wall slope, Dynamic response, HHT

# Determination of shear stress-shear strain behavior of polymeric geostrip reinforced MSE wall

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**Abstract:** In this paper, the shear strain-dependent dynamic response properties of a retaining wall model made of mechanically stabilized earth (MSE) with polymeric geostrip material are investigated in a 1-g shaking table test. The values of lateral displacements and accelerations measured at different points along the MSE wall surface were used to evaluate the equivalent hysteris loops. The effect of reinforcement stiffness and backfill slope angle on the equivalent shear stiffness modulus ($G_e$) and damping ratio ($D$) were investigated. The experimental results show that the variation of shear stiffness modulus and damping ratio as a function of shear strain ($\gamma$) is affected by vertical pressure ($\sigma_v$), but the effect of the stiffness of the polymeric geostrip on the damping ratio is negligible. The variations of the $G_e$, $G_e/\sigma_v$, $G_e/G_{\max}$, and $D$ as a function of $\gamma$ are expressed in exponential equations with high least squares values in this study.

**Keywords:** Polymeric geostrip, Geosynthetic, Damping ratio, Equivalent shear stiffness modulus, Shaking table

# Test and DEM study on cyclic hysteresis characteristics of stereoscopic geogrid-soil interface

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**Abstract:** The bearing resistance provided by the geogrid's transverse ribs is a non-negligible aspect of the strength mechanism in mobilizing the geogrid-soil interface. Therefore, studying its influence on the response mechanism of geosynthetic-reinforced soil structures under cyclic loading is crucial. The stereoscopic geogrids were manufactured using 3D printing technology by quantitatively thickening the transverse ribs of planar geogrids. To investigate the cyclic hysteresis relationship and stress-dilatancy phase-transformation characteristics of the stereoscopic geogrid-coarse particle interface, cyclic direct shear tests were conducted. Additionally, a discrete element method (DEM) was employed to study the evolution of shear bands and fabric anisotropy at the interface under cyclic loading. The results of the study indicate that the stress-displacement phase angle of the stereoscopic geogrid in the horizontal direction of cyclic shear is smaller compared to the planar geogrid. Furthermore, thickening the transverse ribs decreases the stress-dilatancy phase-transformation angle of the interface. The thickness of the interface shear band in the stereoscopic geogrid is greater than that of the planar geogrid. Moreover, as the transverse-rib thickness increases, the principal direction of the average normal contact force and average tangential contact force under cyclic loading also increases.

**Keywords:** Geogrid, Transverse-rib thickness, Cyclic direct shear test, DEM, Phase-transformation angle, Fabric anisotropy

# Shaking table tests on the influence of geosynthetic encasement stiffness on the shear reinforcement effect of GESC composite foundation

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**Abstract:** This paper presents an experimental study of shaking table tests on two geosynthetic encased stone columns (GESC) composite foundation models with different geosynthetic encasement stiffness to investigate the influence of geosynthetic encasement stiffness on the shear reinforcement effect. The reduced-scale GESC composite foundation models were designed according to the similitude relationships by scaling the model geometry, geosynthetic encasement stiffness, and input motions for shaking table tests in a 1 g gravitational field. The GESC composite foundation models were constructed using poorly graded sand, gravel, and geotextile encasement, and then were excited using a series of sinusoidal input motions with increasing peak acceleration. The acceleration amplification factors for the GESC composite foundation model with higher geosynthetic encasement stiffness are larger than those of the lower geosynthetic encasement stiffness model due to the increased stiffness of the composite foundation. The higher geosynthetic encasement stiffness composite foundation has smaller settlements and lateral displacements under the same input motions compared to the lower geosynthetic encasement stiffness composite foundation. The incremental geosynthetic encasement tensile strains increase with increasing input acceleration for both models. The longitudinal tensile effect of geosynthetic encasement plays an important role on the shear reinforcement mechanism of GESC.

**Keywords:** Geosynthetics, Geosynthetic encased stone column, Geosynthetic encasement stiffness, Shaking table test, Shear reinforcement

# Effect of air-boost modes on clogging behavior for vacuum consolidation with prefabricated horizontal drain

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**Abstract:** The air-booster vacuum preloading method is considered a reasonable choice for alleviating clogging problems. However, research on the air-boost mode during the early consolidation stage is still lacking. In this study, a series of comparative experiments were designed to investigate the effects of applying different pressures and durations on the consolidation characteristics of dredged soil and clogging at two consolidation stages using indoor model tests and microscopic tests. The experimental results showed that the air-boost modes of low pressure and short duration should be adopted during the early consolidation stage, and as the continuous consolidation, the pressure and duration should be increased. Moreover, early gas injection had a more significant effect on alleviating clogging of the prefabricated horizontal drain (PHD), and the pore diameter of dredged soil was also smaller. The research results are an important guide for air-booster vacuum preloading to dewater high-moisture dredged soil.

**Keywords:** Air-booster vacuum preloading, Clogging, Air-boost mode, Model test, Microscopic test, Prefabricated horizontal drain

# Effect of geotextiles with different masses per unit area on water loss and cracking under bottom water loss soil conditions

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**Abstract:** Soil water loss is an important component of the water balance in irrigated agriculture. This study investigated the effects of geotextiles on water loss during soil drying and cracking. The results indicate that the residual water content of soil samples increased by 98.5%, 145.5%, and 164.7% with geotextile masses per unit area of 100, 300, and 400 g/m$^2$, compared that of soil without geotextiles. There are two water loss stages of soil, the "rapid loss" and the "residual loss", under the condition of bottom water loss, which is different from the evaporation stage of normal soil without bottom water loss. When a geotextile is added to the soil, the stages of bottom water loss will become "rapid loss, deceleration loss, and residual loss." When the mass per unit area of 400 g/m$^2$ geotextile was used, the crack ratio, probability entropy, and fractal dimensions decreased by 15.19%, 6.47%, and 5.81%, respectively. The geotextile mass per unit area increased the specific surface area of the soil, and water retention was improved. When the mass per unit area of the geotextile increased, the interface friction between the soil and geotextile increased, and the cracking of the soil was effectively inhibited.

**Keywords:** Geotextile, Different masses per unit area, Water loss, Soil cracking