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Editorial: Physico-mechanical properties and treatment technology of hazardous geomaterials–volume II

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Editorial on the Research Topic
Physico-mechanical properties and treatment technology of hazardous geomaterials-volume II

Introduction

New geomaterials and technologies are emerging in every branch of geotechnical engineering, such as soil improvement, underground excavation, tunnel waterproofing, coal engineering, and high-speed railway subgrade measures. These complex projects include the research and treatment of hazardous geomaterials, industrial waste utilization, geopolymer materials, geo-environments and other newly developed materials. The advancement of new materials has promoted the development of geotechnical engineering and its close intersection with other disciplines. In recent years, many scholars have achieved good research results, but the understanding of these new materials and methods is not very clear.

The Research Topic aims to consolidate original research and review articles on recent developments in hazardous geomaterials, synthetic materials and disaster soil reinforcements. A total of sixteen articles are presented in this Research Topic, including theoretical methods, laboratory experiments, numerical simulations and field tests. The Editorial includes the following information.

- Physico-mechanical properties of hazardous geomaterials
- Disaster soils and reinforcement technology
- New materials and special applications

Physico-mechanical properties of hazardous geomaterials

The physico-mechanical properties of hazardous geomaterials under complex environmental conditions have attracted substantial attention from researchers. Yan et al. introduced an elastic

damage element by considering time-dependent damage and verified the unloading creep characteristics of a stiff flint limestone by a large number of triaxial compression grade-unloading creep tests. Huang et al. modified a power function model to explain the creep strain characteristics of coarse- and fine-grained soils and proposed two creep subsidence prediction algorithms considering stress history based on Bjerrum's reclassification of consolidation, which was verified in practical engineering by two widely used subsidence prediction algorithms.

Wang et al. carried out multilevel cyclic loading mechanical tests on flawed marble samples with different fissure angles, and the test results showed that rock strength, fatigue lifetime, peak strain and dissipated energy increase with increasing fissure angle and that the rates of increase become sharp at high cyclic levels. Guo et al. reported the effects of particle size distribution on the shear properties of sand through four types of sand samples with different particle size distributions, and the research results can aid in the understanding of the changes in particle contact, internal stress, and particle sliding during the shear failure of sand.

Zhang et al. investigated the disaster mechanism influenced by freeze–thaw cycling and hanging wall mining in an open pit iron mine by a 3-dimensional intelligent recognition technology (i.e., a laser scanning method) and numerical simulation, which can effectively reveal the stress, displacement, plasticity zone, and maximum shear strain patterns in detail. Chen et al. delved into explored the mechanical behaviors of mixed soils across various particle contents and sizes using direct shear testing and dissected the distinctive mechanical responses by examining the interplay of particle contact interfaces and adsorption energy through a multiscale energy approach. The experimental research of Deng et al. revealed that the cohesion of saturated reinforced soil exhibited a significant decrease relative to unsaturated reinforced soil, with matrix suction serving as a critical consideration for reinforced structural design, and the results obtained using postshear moisture content were closer to the measured values than those using initial moisture content.

Disaster soils and reinforcement technology

The disposal and reinforcement technology of disaster soils is an important Research Topic in the field of geo-environmental engineering. Yang et al. established a constitutive relationship of a cable body on the basis of the coupling of corrosion force with statistical damage mechanics, derived the relationship between the degree of corrosion of the cable body and the holding prestress using the load transfer method, and verified the rationality of highway slopes during the operation period by actual measurements. Han et al. investigated the influence of the flocculant dosage on the drainage behavior and experimentally showed that the coefficient of secondary consolidation is very significant in slurries modified by the flocculation-enhanced surcharge (vacuum) preloading method. Yang et al. conducted model experiments to reveal the changes in water level outside the pit caused by precipitation, which provided a research basis for the reasonable control and prevention of surface settlement and for the adverse deformation of diaphragm walls in narrow spaces under subsequent seepage conditions in the surrounding area.

By taking the homogeneous slope model as an example, Li et al. analyzed the influences of the location and depth of a single fracture on slope stability and of slope top fractures on the slope seepage field and slope stability with and without rainfall. To make a new type of vertically loaded double-plate anchor, Xing et al. investigated the influences of parameters on the ultimate penetration depth in soft clay and showed that increasing the length of the bottom fluke could increase the ultimate penetration depth when the included angles were the same in clay with zero strength and in clay with uniform strength at the seabed. Feng et al. determined the bearing capacity of a prestressed high-intensity concrete pipe pile (a cement–soil mixing pile) by applying a slow-speed maintenance load, discovering that the characteristic value of the bearing capacity could reach 2,300 kN; this research provided design references for similar site foundation projects.

New materials and special applications

New geomaterials are emerging in many complicated and special geotechnical engineering applications. Dong et al. proposed a prefabricated underground utility tunnel featuring a composite shell system as a new system; the study showed that the composite shell top plate specimen had good collaborative performance, and the researchers proposed an accurate bearing capacity formula. Zhao et al. used a silane coupling agent to modify polyvinyl alcohol (PVA) fibers and discussed the mechanism influencing the modification of the admixture by experimentation and molecular dynamics simulation; macroscopic mechanical experiments showed that the bending resistance of PVA fiber concrete significantly improved after PVA fiber modification.

Li et al. addressed the issue of large solid waste output and surface subsidence and focused on the large filling working face of a typical mine; the scholars employed a combination of theoretical analysis, numerical simulation, and field practice to analyze the limit caving and cycle pressure characteristics of the working face.

Although the submission for this Research Topic has been closed, more in-depth research in the field of hazardous geomaterials and geotechnical environment is being conducted to address these challenges. All of the selected contributions help discover innovative methods and advanced technologies in this field. We would like to thank all editors, reviewers and authors for their crucial contributions.

Author contributions

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Conflict of interest

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