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Editorial

Dynamic Failure Characteristics and Behavior of Rock Materials

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This special issue compiles thirty-seven original papers covering the following topics: dynamic constitutive relation and strength criterion of rock, rock dynamic testing method and technology, dynamic mechanical properties and behavior of rock, propagation law of the stress wave in rock mass, prevention and control of dynamic failure in rock engineering, mechanical response of rock under impact loading and blasting loading, and numerical simulation of rock dynamic failure.

Fifteen articles in this special issue involve the mechanical response and the constitutive relation of rock under blasting loading and impact loading. J. Zuo et al. study the fractal deep-hole blasting and its induced stress behavior of hard roof strata in Bayangaole Coal Mine, China. The fractal blasting layouts that would be conducive to the enhancement of the blasting effects are investigated. Y. Yang et al. investigate the effect of an adjacent hole on the blast-induced stress concentration in rock blasting. Influences of the key parameters of the adjacent hole effect on rock blasting, pitch of holes, adjacent hole diameter, and uncoupled medium in a blasting hole are extensively explored. Q. Wang et al. develop a coupled damage-permeability constitutive model for brittle rocks subjected to explosive loading. For investigations of the rock material concerning dynamic impact loading, W. Wang et al. analyze the dynamic impact mechanical characteristics of prestressed saturated fractured coal and rock using the split-Hopkinson pressure bar. The experimental results for coal are compared with the corresponding characteristics of typical sandstone samples under static and static-dynamic loads. F. Ju et al. investigate the vibration and dynamic response of buffering devices during the vertical feeding of coal mine solid backfill materials. The functional characteristics of buffering devices are analyzed, and a buffering device is designed. L. Dong et al. summarize the theories and methods for dynamic stability analysis of rockmass. S. Wang et al. study the effects of radial gradient stress and confining pressure on the impact of compression of sandstone using a large-diameter split-Hopkinson pressure bar. Z. Han et al. investigate the effects of preexisting flaws with different geometries, including flaw inclination angle and ligament angle, on dynamic strength, deformation properties, and fracture evolution of rock materials using a 75 mm diameter split-Hopkinson pressure bar (SHPB) testing device with a high-speed camera recording in real time. X. Qian et al. also investigate the fracture characteristics of heterogeneous rocks with preexisting surface flaws under dynamic loadings. Different types of cracks from initiation to coalescence of the specimen with a single flaw are reproduced in numerical tests, which highly agreed with experimental results. K. Man and X. Liu show the dynamic fracture toughness and dynamic tensile strength of the rock from different depths of Beijing Datai Well. C. Yan et al. identify the impact factors of the dynamic strength of mudded intercalations during cyclic loading. Y. Zhang et al. indicate the dynamic response law of the bank slope under water-rock interaction. P. Yuan et al. investigate the influence of nonparallel end-surface on stress uniformity during the loading process in the rock SHPB test. A paper by Q. Zhang et al. studies the seismic response for wave propagation with an arbitrary incident angle impinging on

joints. Y. Wang and J. Liu comprehensively calculate three types of mechanical instability criteria. The limit radius of the interlayer is computed under different criteria, and the collapse radius of the interlayer is obtained by comparison.

Eight papers are related to the prevention and control of dynamic failure in rock engineering. A paper by X. Sun et al. introduces the design of gob-side entry retaining through precut overhanging hard roof (GERPOHR) and optimizes the layout of the working face. Based on the adjacent chamber and roadway group of −850 m level in Qujiang Mine, China, W. Yu and F. Liu analyze the stability and control technology of surrounding rock in the main shaft and auxiliary shaft system. Y. Liu et al. explore the particle size effect of simulated fault gouge on slip characteristics by the conventional double-direct shear friction configuration combined with acoustic emission (AE). F. Chen et al. explore the law of large-scale deformation and failure of soft rock based on microseismic monitoring. For the investigation of rockbursts, G. Su et al. systematically investigate the influences of support failures, including support forces, support failure timings, and support failure rates, on rockbursts under true-triaxial condition. S. You et al. report the damage evaluation for rock burst proneness of deep hard rock under triaxial cyclic loading. Y. Yang et al. give the fatigue characteristics of limestone under triaxial compression with cyclic loading. The correlation between the elastic energy index and damage evolution is built, and rock burst proneness in each status is analyzed. An article by J. Pan et al. introduces a typical rockburst process, its classification, mechanism of internal and external causes, and energy criterion.

Six articles in this special issue investigate the rock dynamic failure in terms of numerical simulation. L. Li et al. show the influence of bidirectional impact loading on anomalously low-friction effect in block rock media and establish a numerical model. K. Zhao et al. analyze the structural stability of the cemented fill under different cement-sand ratios and concentration conditions through numerical calculation. X. Lv et al. construct a simplified mechanical model for the analysis of dynamic destabilization of the overlying strata during underground mining. X. Wang et al. propose a numerical analysis method of shear properties of infilled joints under constant normal stiffness condition. In addition, a paper by X. Fan et al. studies the failure behavior of intermittent rock joints under direct shear loads by means of both physical tests and numerical simulations. Z. Zhang et al. analyze the dynamic response of heavy-haul railway tunnels under long-term reciprocating cyclic dynamic loads considering the factors such as axle load of the vehicle body, unsprung mass, and track irregularity.

Five articles in this special issue give the energy changes and variation performance of rock and coal subjected to dynamic loads. S. Wang et al. study the strength, acoustic emission, and energy dissipation of coal under naturally and forcedly saturated conditions. L. Chen et al. investigate the energy propagation and scattering characteristics in rock with a series of split-Hopkinson pressure bar (SHPB) impact tests. C. Xin et al. analyze the effects of geometrical parameters on one-dimensional stress wave transmission and energy dissipation across a single rough joint. D. Zhuang et al. investigate the energy changes in deep tunnels during the TBM tunneling of the Jinping II Hydropower Station using microseismic monitoring. L. Yan et al. determine and analyze the pore structure and distribution, propagation characteristics of stress waves, changes in initial tangent modulus, and energy dissipation in weakly weathered granites of different porosities.

Additional papers are associated with dynamic mechanical properties and behavior of rock materials. A paper by M. Gao et al. analyzes the dispersion curves of the nonlinear metamaterial with a pure Duffing oscillator utilizing the Lindstedt -Poincaré method. An article by F. Feng et al. shows the seepage flow characteristics and disaster-causing mechanism of the collapse column. The permeability coefficient of the broken rock under different conditions is measured by using the self-designed equipment. W. He and Z. Zhang model the creep fracture in rock by using the Kelvin discretized virtual internal bond.

Conflicts of Interest

The guest editors declare that there are no conflicts of interest involved in the publication of this special issue.

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