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Study on Segregation Effect in Debris Flow Particles

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Abstract: The debris flow is a multiphase fluid in which a large amount of solid particles and liquid water are mixed.

The Segregation of debris flow particles will have a major impact on the flow and accumulation of debris flow, as well as on the stress of buildings. This is also the focus of research on debris flow prevention and control in recent years. In this paper, computational fluid dynamics (CFD) and discrete element method (DEM) are used to simulate six sets of debris flow motion to obtain the position, velocity and force of particles during each debris flow. According to the position data of particles, the calculation method of particle segregation degree is proposed and the segregation degree of each part of six texts of particles are calculated. The relationship between segregation and debris flow movement is studied. The results show that the segregation of debris flow will affect the movement of debris flow, mainly in the following points: (1) The degree of segregation of the particles is positively correlated with the degree of particle non-uniformity; (2) The higher the segregation degree, the greater the energy consumed in the early stage of debris flow head formation, the smaller the total kinetic energy; (3)The greater the degree of segregation, the smaller the energy consumed by segregation, and the kinetic energy of the debris flow will continue to increase. At the same time, the speed amplification factor will increase with the increase of the degree of segregation, and the further the moving distance will be.; (4) Discrete low particles dissipate more energy and accumulate less height when stacked; in general, the higher the isolation degree,

Table 1 Data accumulated by particles in front of the baffle

Test	Maximum total kinetic energy (*J*)	Average degree of segregation	Accumulation height at the baffle (*m*)	Impact force (*N*)
1	522.540	0.82	1.6	35059.1
2	910.390	0.82	1.7	35332.1
3	984.100	0.76	1.5	33157.4
4	899.610	0.62	1.4	25883.7
5	1047.400	0.45	1.4	25829.5
6	1104.900	/	1.4	25427.2

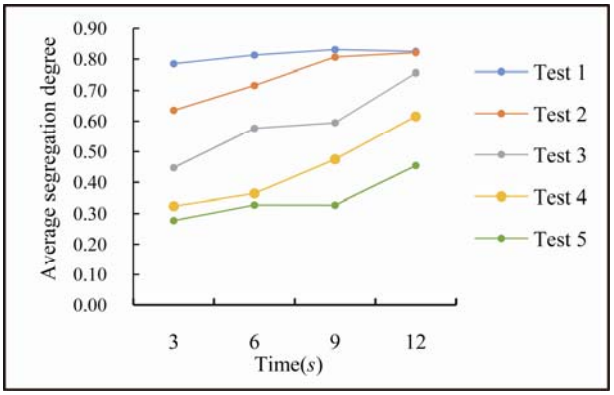

Fig. 1. The results of the average segregation degree calculation for each test.
From test1 to test5, the more uniform the particles, the lower the sorting score.

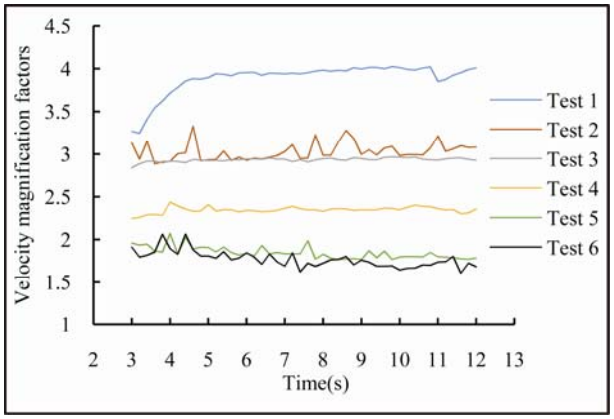

Fig. 2. Velocity magnification factors of the head of different particles versus time
From test1 to test6, the more uniform the particles, the lower the velocity magnification factors.

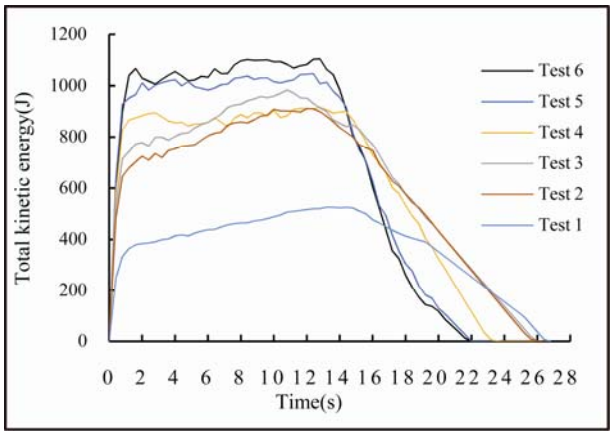

Fig. 3. The relationship between the total kinetic energy of each test particle and time.

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the greater the force.

Keywords: Debris flow; CFD-DEM, Fluid-solid coupling , Segregation degree, Segregation effect

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