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Parameters of a discrete element ballasted bed model based on a response surface method

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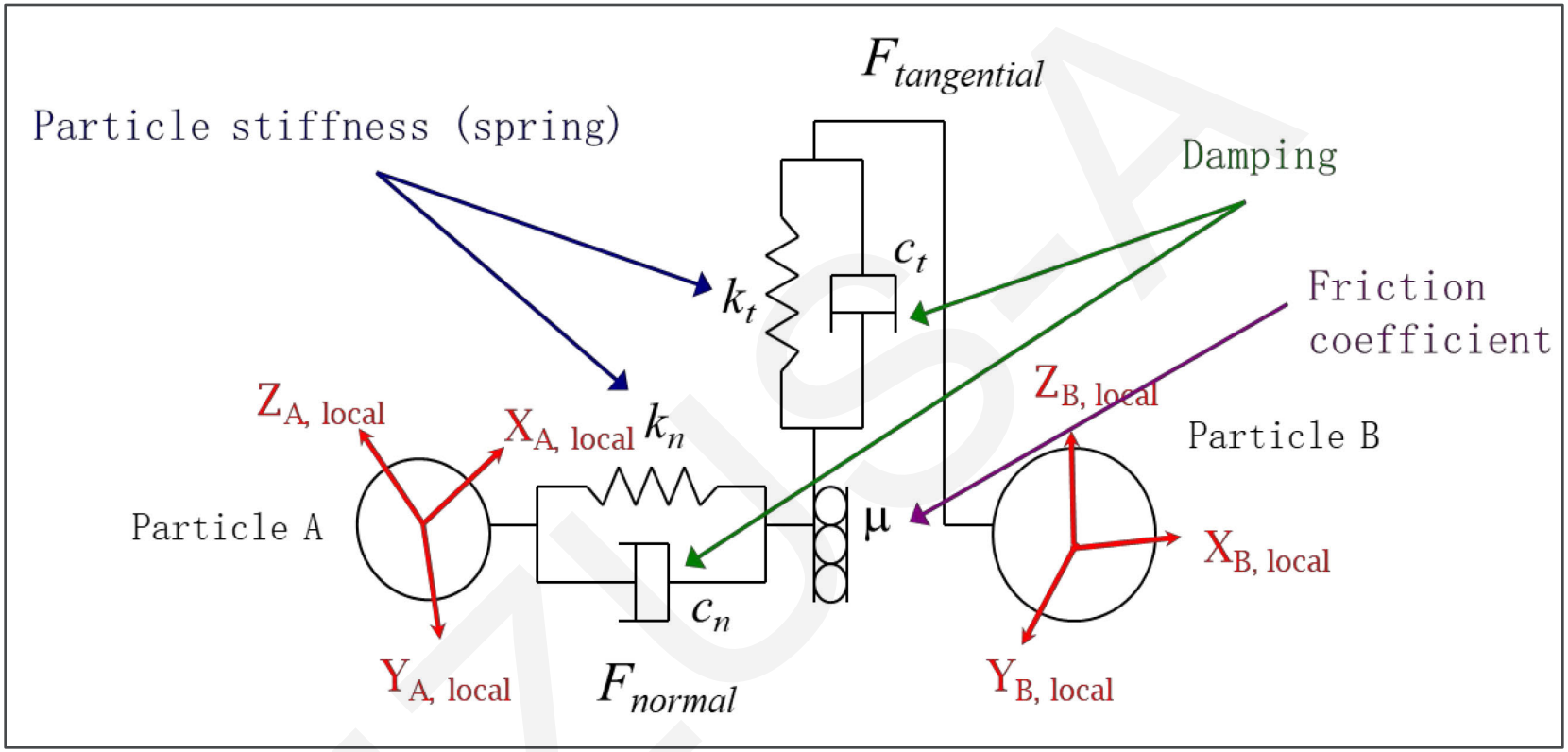
DEM Parameters

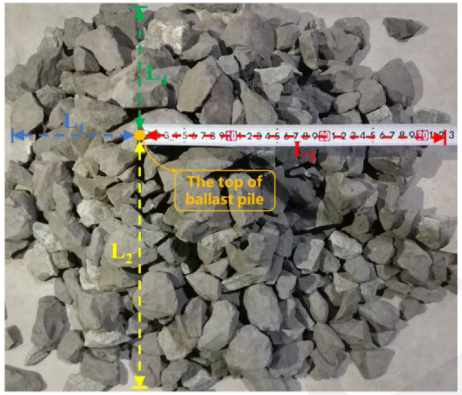


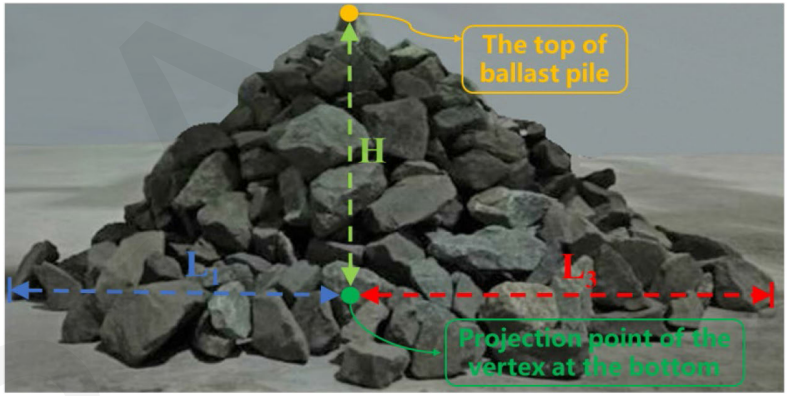
category

- **Intrinsic parameters**: density, Poisson's ratio, Young's modulus and shear modulus → Directly measured
- **Contact parameters**: coefficient of restitution, coefficient of static friction and coefficient of rolling friction → **Calibration**

Laboratory Test

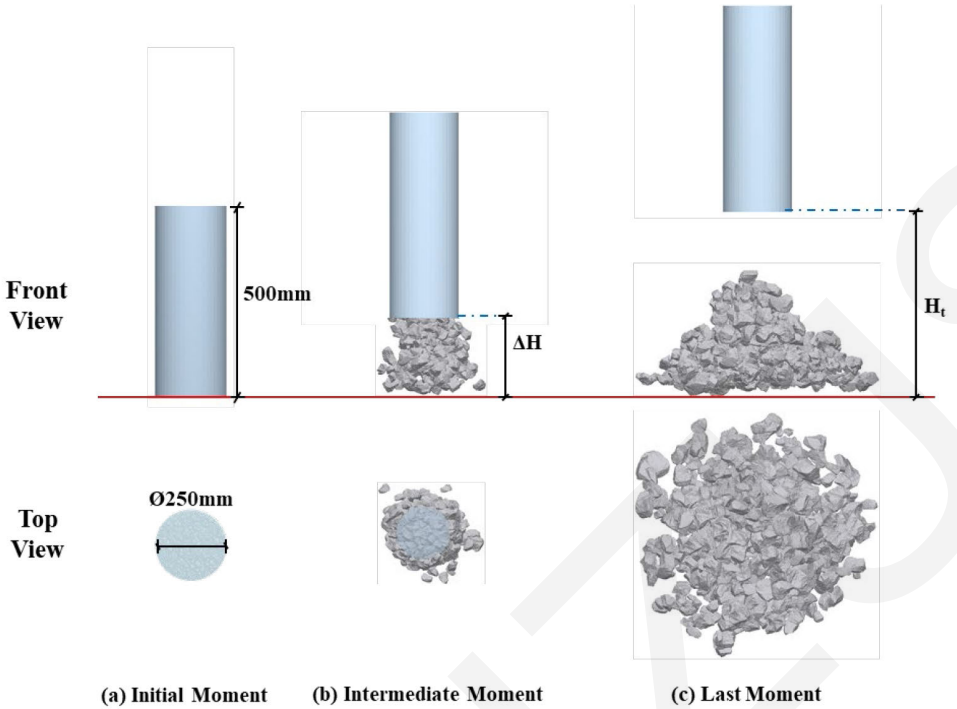




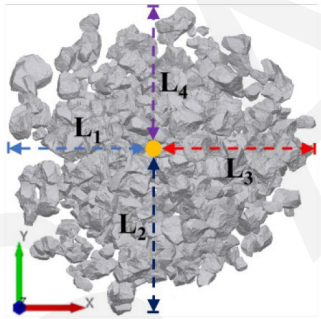


Test number	H (mm)	L_1 (mm)	L_2 (mm)	L_3 (mm)	L_4 (mm)	(mm)
1	32.6	36.0	39.5	43.0	35.6	37.3
2	32.3	36.0	25.0	31.0	36.0	32.1
3	32.0	36.0	45.0	35.0	31.5	35.9
4	31.0	35.0	27.0	36.0	29.0	31.6
5	29.5	30.0	42.0	39.5	37.0	35.6
6	27.0	40.0	39.0	40.0	52.0	39.6
7	28.7	43.0	39.0	37.0	36.0	36.7
8	29.0	35.0	37.0	43.0	30.0	34.8
9	30.0	27.0	31.0	34.0	33.0	31.0
10	27.4	31.0	42.0	41.0	29.0	34.1

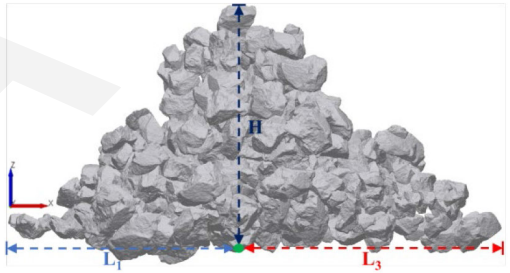
Simulation Test



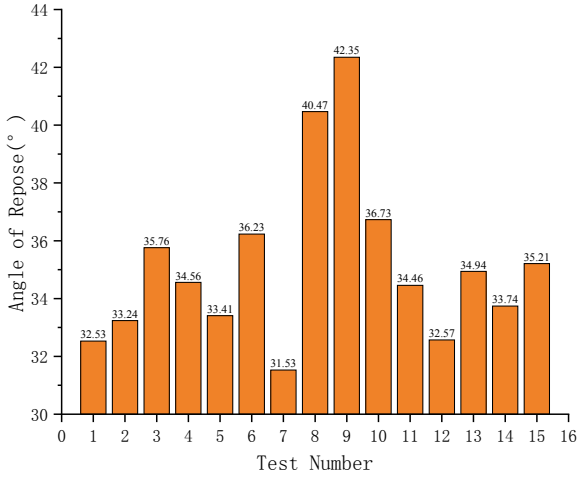
Simulation process



Top view

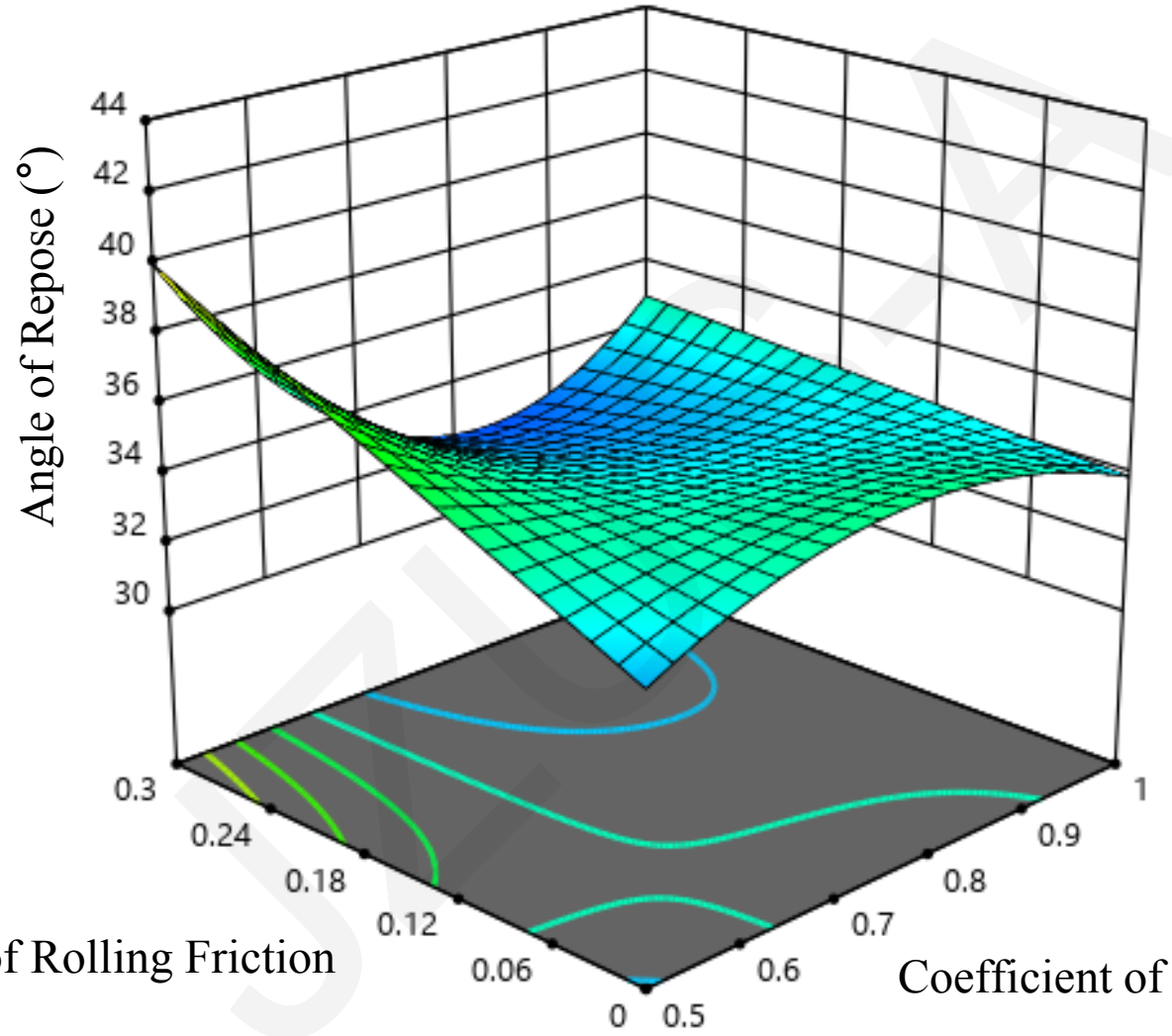


Front view



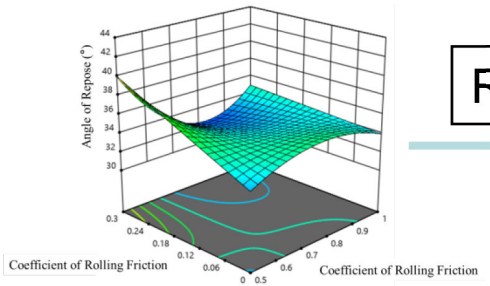
Test results

Response Surface Method



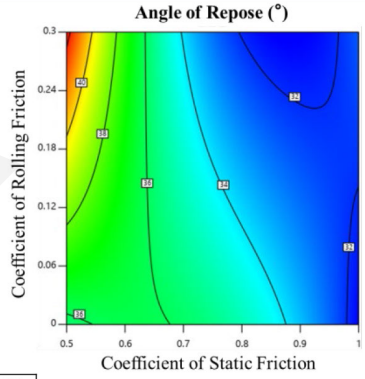
The coefficient of restitution is 0.50.

Conclusions

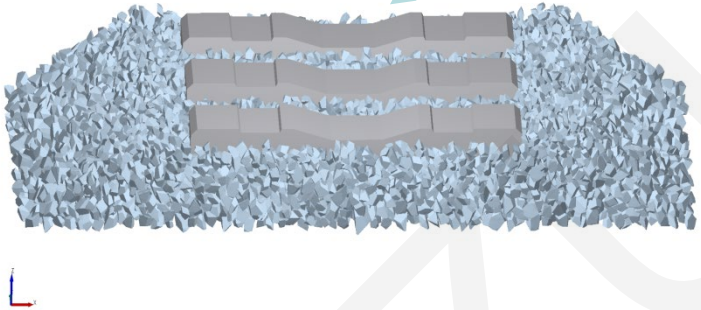


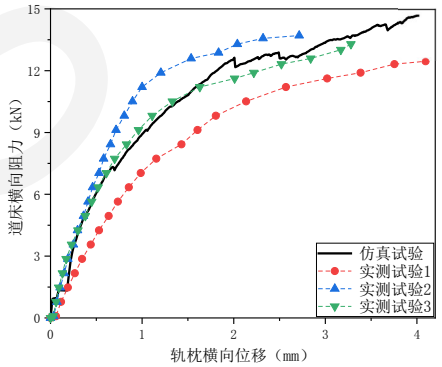
RSM

- **Optimal Parameters：**
  - **restitution coefficient: 0.72**
  - **static friction coefficient: 0.56**
  - **rolling friction coefficient: 0.27**



The coefficient of restitution is 0.75.





1. By averaging the angles of repose of the four orthogonal surfaces, the angle of repose of Chinese special-grade ballast naturally accumulated in the laboratory was (39.78±1.27)° .

2. The optimal model parameters were as follows: Poisson's ratio is 0.24, density is 2600 kg/m^3, Young's modulus is 5.45×10^{10} Pa, restitution coefficient is 0.72, static friction coefficient is 0.56, and rolling friction coef-ficient is 0.27.

3. which indicated that the contact parame-ters obtained by response surface method can be used for discrete element simulation of the ballasted bed.