

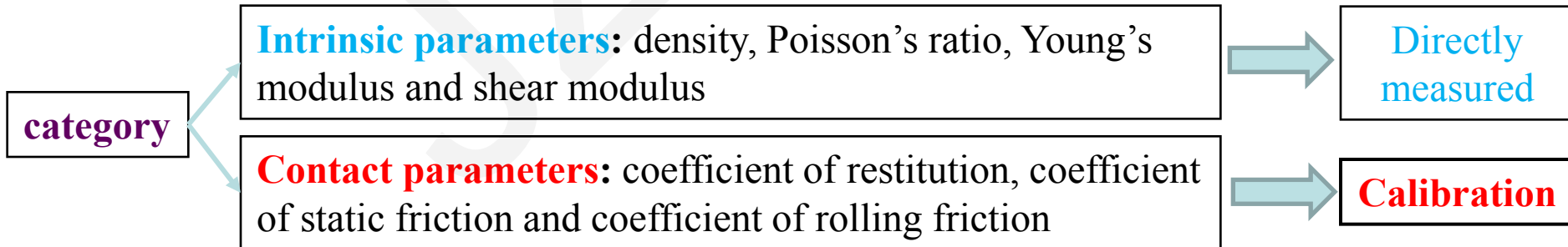
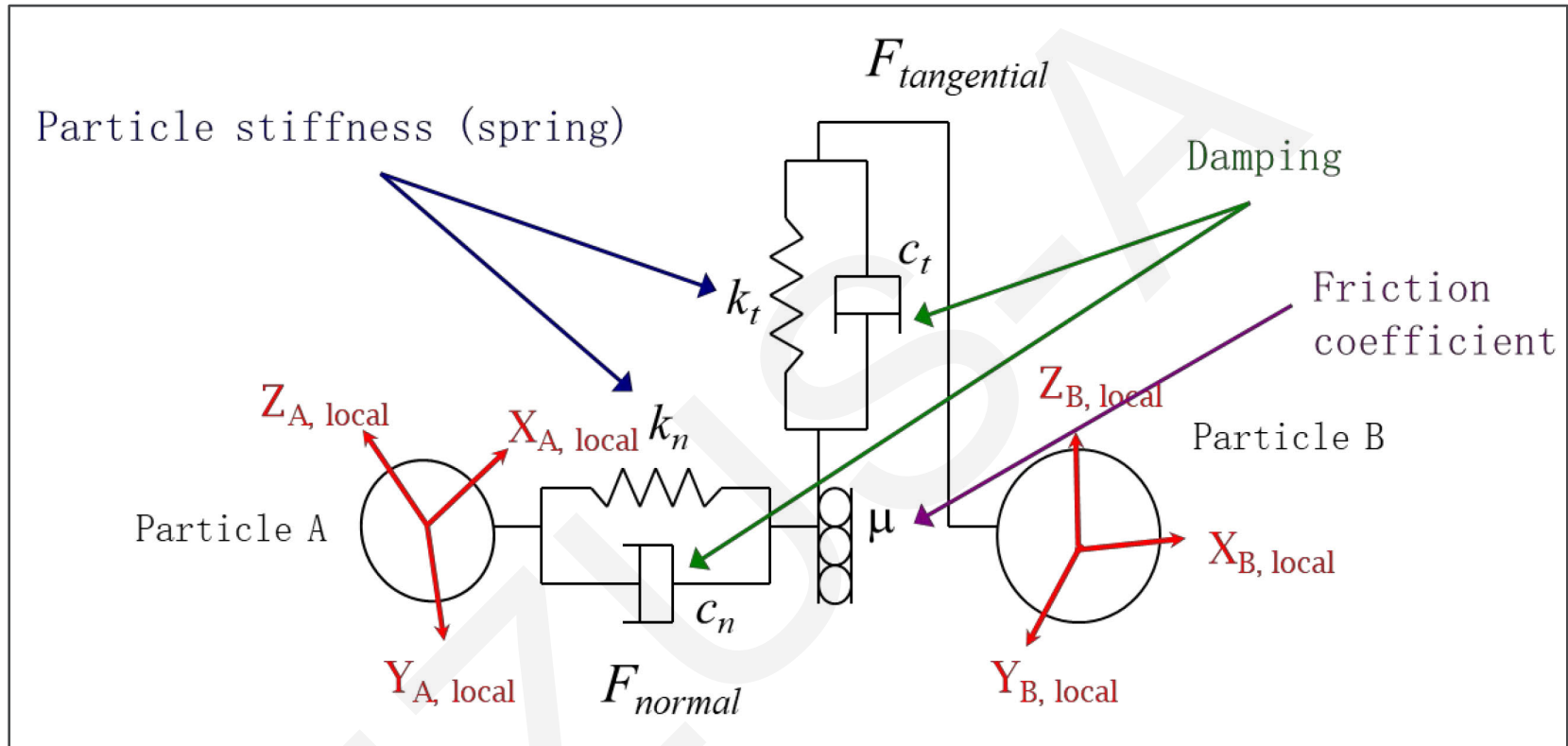
# Parameters of a discrete element ballasted bed model based on a response surface method

**Jie-ling Xiao, Gan-zhong Liu, Jian-xing Liu,  
Jia-cheng Dai, Hao Liu, Ping Wang**

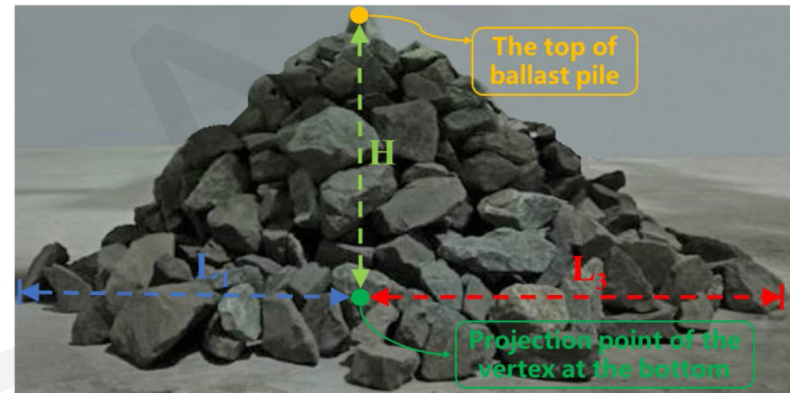
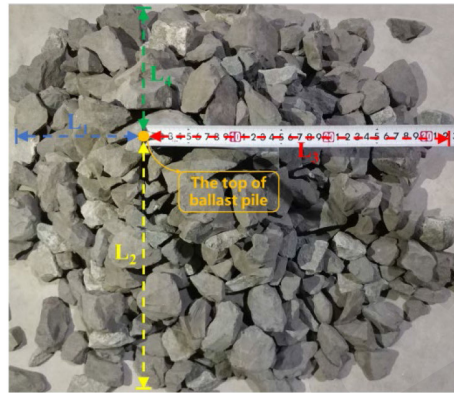
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# DEM Parameters

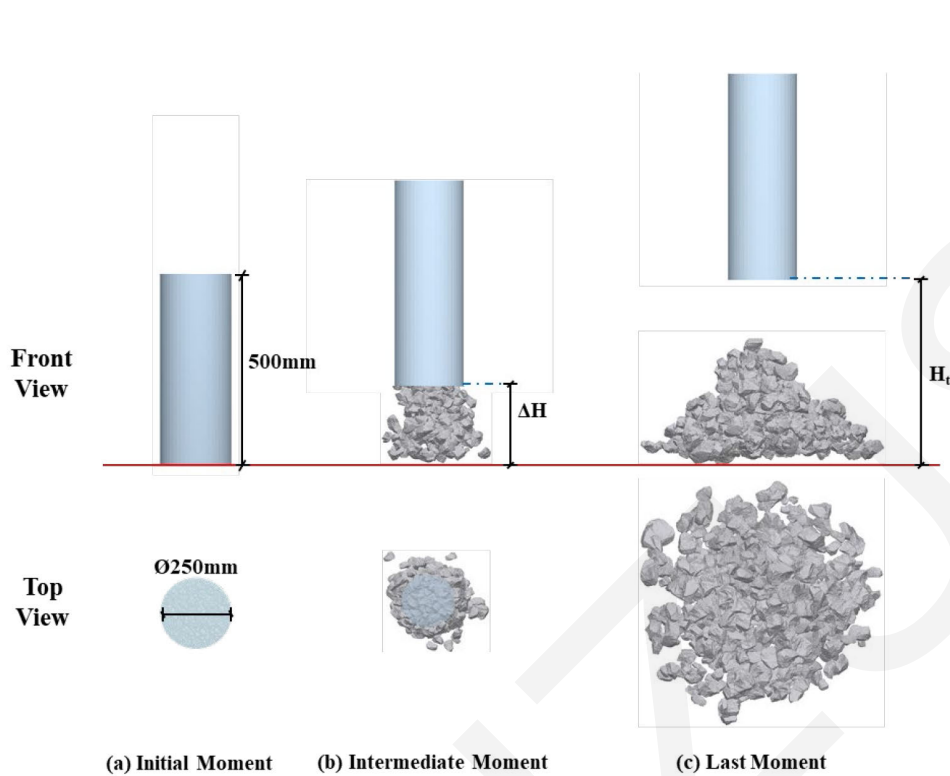


# Laboratory Test

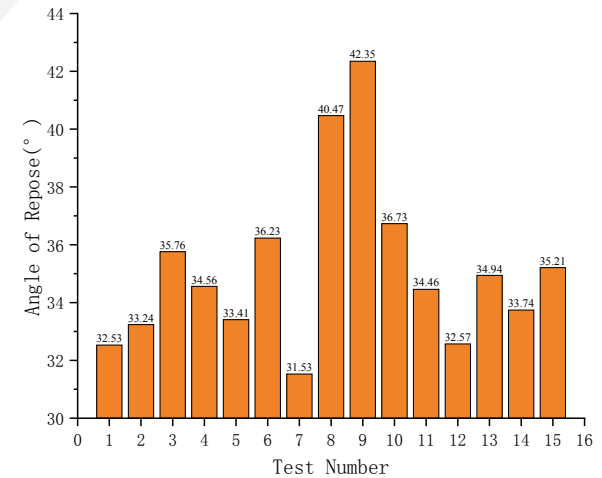
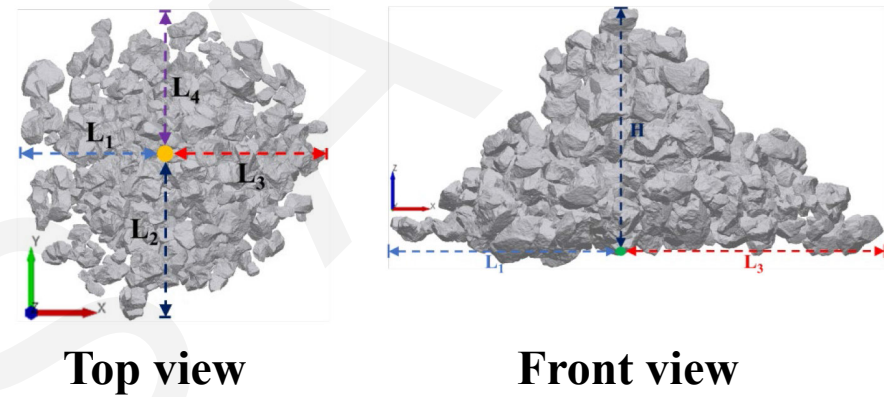


Test number	H (mm)	$L_1$ (mm)	$L_2$ (mm)	$L_3$ (mm)	$L_4$ (mm)	(mm)
1	32.6	36.0	39.5	43.0	35.6	37.3
2	32.3	36.0	25.0	31.0	36.0	32.1
3	32.0	36.0	45.0	35.0	31.5	35.9
4	31.0	35.0	27.0	36.0	29.0	31.6
5	29.5	30.0	42.0	39.5	37.0	35.6
6	27.0	40.0	39.0	40.0	52.0	39.6
7	28.7	43.0	39.0	37.0	36.0	36.7
8	29.0	35.0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

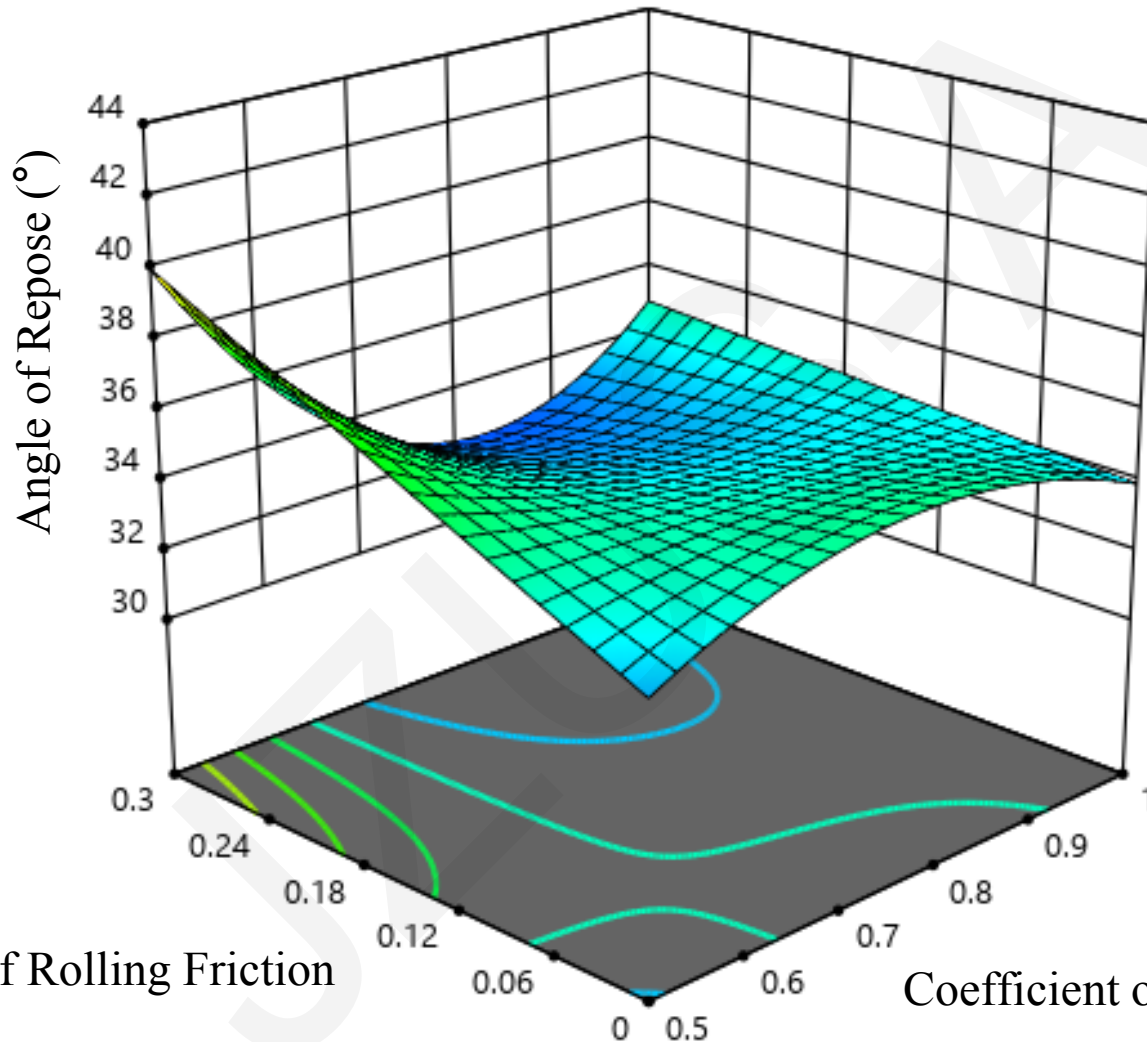


Simulation process



Test results

# Response Surface Method

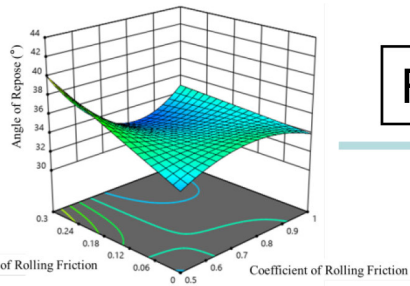


Coefficient of Rolling Friction

Coefficient of Rolling Friction

**The coefficient of restitution is 0.50.**

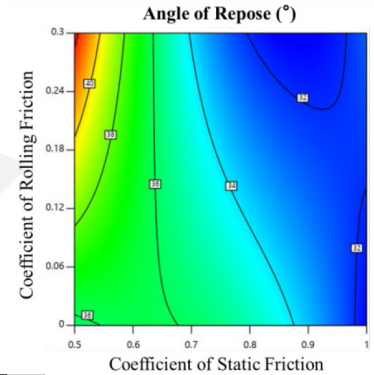
# Conclusions



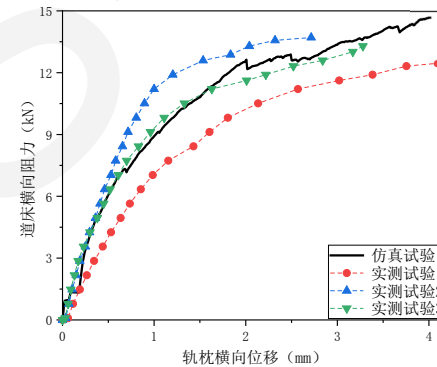
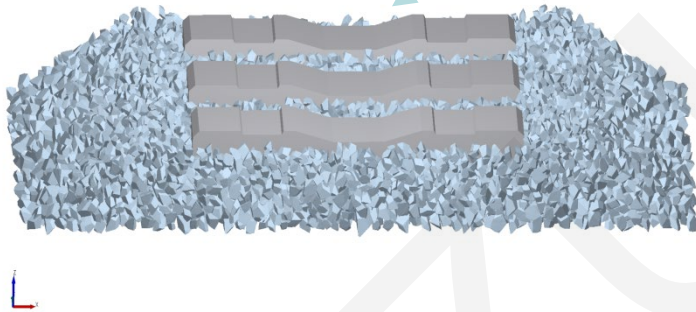
RSM

## ➤ 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  $(39.78 \pm 1.27)^\circ$ .
2. The optimal model parameters were as follows: Poisson's ratio is 0.24, density is  $2600 \text{ kg/m}^3$ , Young's modulus is  $5.45 \times 10^{10} \text{ Pa}$ , restitution coefficient is 0.72, static friction coefficient is 0.56, and rolling friction coefficient is 0.27.
3. which indicated that the contact parameters obtained by response surface method can be used for discrete element simulation of the ballasted bed.