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DISCRETE ELEMENT MODELLING OF SHEAR DEFORMATION OF ROUGH PARTICLES

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In shear flow of powders and grains, particles slide and roll over each other. Consequently, their tribological properties such as friction and adhesion play a major role in their flow behaviour. Particle surface roughness strongly influences bulk material flow through its effect on adhesion and friction [1]. Nevertheless the prediction of bulk flow behaviour by numerical modelling has received little attention. There have been some attempts to include particle surface roughness in Discrete Element Method (DEM). These can be categorised into two groups: direct geometry refinement, and contact model enhancement. Direct inclusion of roughness in DEM modelling has been carried out by assuming that asperities are small spheres which are bonded to the main particles. This methodology is computationally expensive and restricted to spherical shape surface roughness. On the other hand, enhancement of normal force-displacement relationship for rough surfaces has been conducted using the statistical approach of Greenwood and Tripp [2, 3]. This work is limited to normal direction and the spherical shape of asperities. In this study, Boundary Element Method (BEM) is coupled with DEM to predict the bulk behaviour of particulate solids more accurately. An in-house BEM code developed by Ghanbarzadeh *et al*. [4] is employed to calculate the normal force-displacement curves. This is an efficient and relatively fast method of calculating the contact mechanics of rough surfaces. Then the contact deformation characteristics is inputted in DEM to determine the effect of surface roughness on flowability and angle of repose of powders and grains. The study highlights the effect of surface characterisation parameter on contact behaviour of particles.

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