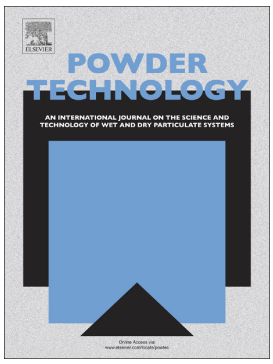

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Capturing particle-particle interactions for cylindrical fibrous particles in different flow regimes

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Abstract:

Non-spherical particles are widely used in the chemical and pharmaceutical industries. Often these particles are over-simplified as equivalent spherical particles for calculation of drag forces and particle- particle interactions. We have developed a three-dimensional discrete element method (DEM) for rigid cylindrical fibrous particles with a high aspect ratio. In this method, a cylindrical particle was represented as overlapped multiple spheres. The diameter of the spheres was the same as that of the fibrous particle, while the number of spheres was determined by the length of the fibrous particle. The simulations were carried out for different numbers of particles to study the dynamics of fibrous sedimentation and also to investigate the effect of particle- particle interactions on the average preferred orientation and terminal velocities of the particles. The simulation results are compared to experimental data with good agreement. It is shown that the particles interactions have a significant effect on the particles average orientation and terminal velocity in freely falling particles. However, for fibrous particles moving in a jet flow, the interactions have negligible influence on the particle orientation and terminal velocity.

1. Introduction

Cylinder- like fibrous particles transport in fluids can be seen in different industrial processes including biomass combustion, polymer suspension, fluidized beds and papermaking [1, 2]. Understanding the aerodynamic behaviour of fibrous particles is very important to design, scale-up, and improve the performance of these industrial systems [1, 3]. Some studies have been conducted on the motion of cylindrical particles in two- phase flows [3-5]. Yin et al. [5] have studied the motion of a single PVC cylindrical particle in stagnant water. Their

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