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PROCEEDINGS

Inertial and Particle Shape Effects on Fluid-Particle Suspension Flows: A Resolved SPH-DEM Study

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ABSTRACT

The rheological behavior of fluid-particle suspensions affects the flow dynamics of natural processes such as lavas, flow-type landslides and sediment transport. This study presents results of fully resolved simulations of monodisperse non-Brownian suspensions in a Couette flow using the smoothed particle hydrodynamics (SPH) method coupled with discrete element method (DEM), which allows for simulation of arbitrary-shaped particles. Several benchmark tests have been conducted to verify the reliability of the method. Two density ratios are considered in the study, i.e., 2.65 and 10, with the average particle area fraction varying from 14% to 47% and particle Reynolds number varying from 0.15 to 4.5. Unlike most of the existing studies, we explore the effect of different particle aspect ratio and convexity. The influence of particle shape and inertia varying with the particle density and Reynolds number is studied, both of which significantly affect the contributions of particle-fluid and particle-particle interactions to the stress, leading to the change in the suspension rheology. Moreover, the anisotropy in microstructure is investigated through the pair distribution function g(r), and particle rotation is presented to show the particle kinematics.

KEYWORDS

Suspension rheology, fully resolved SPH-DEM, shear flows, particle shape, inertia

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