Monodisperse gas-solid mixtures with intense interphase interaction in Two-Fluid Smoothed Particle Hydrodynamics

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ABSTRACT

Simulations of gas-solid mixtures are used in many scientific (e.g. planet formation processes) and industrial (e.g. chemical reactors with dispersed catalyst) applications. Two-Fluid Smoothed Particle Hydrodynamics (TFSPH) is an approach when gas and solids are simulated with different sets of particles interacting via drag force. Several methods are developed for computing drag force between gas and solid grains for TFSPH [1,2].

Computationally challenging are simulations of gas-dust mixtures with intense intephase interaction, when velocity relaxation time t_{stop} is much smaller than dynamical time of the problem. In explicit schemes the time step τ must be less than t_{stop}, that leads to high computational costs. Moreover, it is known that for stiff problems both grid-based and particle methods may require unaffordably detailed spatial resolution to get over numerical overdissipation. To address this problem we developed fast and nondissipative method for computing stiff and mild drag force [3] in gas solid-mixtures based on the ideas of Particle-in-Cell approach. In the paper we compare the results of new [3] and previously developed [1,2] methods on several test problems with intense and mild interphase interaction.

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