Title

Discontinuous shear thickening for a dilute gas-solid suspension in inelastic Maxwell models

Abstract

The Boltzmann equation for inelastic Maxwell models is considered to determine the velocity moments in a dilute gas-solid granular suspension under simple shear flow. First, the rheological or non-Newtonian properties (which are related to the second-degree velocity moments) are exactly determined in terms of the shear rate and the coefficient of restitution. Our results show in the steady-state the so-called discontinuous shear thickening, namely, the granular temperature, the non-Newtonian shear viscosity, and the normal stress differences increase drastically with increasing the shear rate. The above theoretical results agree very well with recent molecular dynamics simulations performed for inelastic hard spheres [1]. As a complement of the previous analytical results, the fourth-degree moments are also computed. These moments provide an indirect information on the velocity distribution function, especially in the high velocity region. As in the case of *dry* granular gases [2], it is shown that the fourth-degree moments diverge for shear rates larger than a critical value. This critical value depends on the coefficient of restitution. Finally, a BGK-like kinetic model of the Boltzmann equation is also considered to get all the velocity moments as well as the explicit form of the velocity distribution function [3].

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[2] A. Santos and V. Garzó, J. Stat. Mech. P08021 (2007).

[3] R. Gómez González and V. Garzó, J. Stat. Mech. P013206 (2019).