

Abstract Submitted
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Mixture Stress in a Non-Uniform Suspension¹ QUAN ZHANG, ANDREA PROSPERETTI², Johns Hopkins University — In nature, most suspensions are non-uniform and the particles are subjected to external forces, such as gravity. The external force induces relative motions between the particles and the fluid, which introduce a new degree of freedom. We investigate the ensemble averaged stress system in a non-uniform suspension of equal spheres with external forces. It is found that, as a consequence of the spatial non-uniformity of the particle distribution and the relative motion between the two phases, new terms arise in the symmetric part of the bulk stress. In addition, an anti-symmetric contribution is found even in the absence of external torques. All the new terms in the stress tensor depend on the particle volume fraction and the gradient of the relative velocity but, for a given volume fraction, are independent of the particle size. To determine the new transport coefficients for small volume fractions, the renormalization method is extended to the non-uniform situation. For finite volume fractions, numerical simulations of several prototypical physical problems are carried out, from which the new transport coefficients are calculated. The numerical results agree well with the dilute limit calculations.

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