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The reciprocal effect of lubrication and contact forces in shear-thickening of colloidal suspensions SAFA JAMALI, ARMAN BOROMAND, JOAO MAIA, Case Western Reserve Univ — Recently, the shear-thickening of colloidal suspensions at high shear rates in general, and the so-called discontinuous shear-thickening (DST) in particular, has been attributed to frictional contact forces at high shear rates. This emerging understanding of the contact forces in a suspension has brought back the well-known dilatancy theory which was rather dormant in the past two decades. Here, we study the necessity of short-range hydrodynamics and the correlation between the contact and lubrication forces in shear-thickening suspensions. We use a modified Dissipative Particle Dynamics method that includes squeeze mode lubrication potentials based on the pair drag between two interacting colloids. The effect of simulation parameters and contact potentials on the rheological response of a suspension is studied. Our results show that although the quality of the shear-thickening behavior (whether DST can be obtained or not) is dominated by the contact potentials, the lubrication force is a prerequisite for any type of shear-thickening to be recovered. Needless to mention that this argument is valid for the high Péclet numbers, as opposed to shear-thinning regime which can be fully reproduced without the need to lubrication or contact potentials.

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