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**Dissipative hydrodynamics (DHD) of rigid spherical particles**[1]
ALBERT KIM, YONG SHI, University of Hawaii at Manoa — Phenomena of many spherical particles in aqueous phase are ubiquitous in a plethora of natural and engineered processes. Brownian dynamics (BD), as originated from molecular dynamics (MD), is inherently limited to point-particles governed by the Oseen diffusion tensor. Stokesian dynamics (SD) incorporates accurate multi-pole expansions and lubrication for accurate far- and near-field hydrodynamic interactions, respectively. Dissipative particle dynamics (DPD) overcame the relaxation-time restriction of BD and SD by developing Fokker-Planck equations including the Wiener process, but allowed pair-wise superposition of approximate hydrodynamic interactions. We unified DPD and SD and developed dissipative hydrodynamics (DHD) of rigid spherical particles, which incorporates many-body hydrodynamics of SD formalism and satisfies the fluctuation-dissipation theorem. DHD is more rigorous than SD and BD, and its accuracy is controllable with the choice of time step. Translations and rotations, influenced by both deterministic and random forces exerted on all the particles, can be accurately mimicked in a given uniform or shear flow within a range of the mean free path of a particle.

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