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Direct Numerical Simulations for Colloidal Dispersions

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Summary

We developed a unique method for direct numerical simulations (DNS) of dense colloidal dispersions [3, 5]. This method, called the smoothed profile method (SPM), enables us to compute the time evolutions of colloidal particles, ions, and host fluids simultaneously by solving Newton, advection-diffusion, and Navier-Stokes equations so that the electro- hydrodynamic couplings can be fully taken into account. We have applied the SPM successfully for simulating dynamics of various particle dispersions, including colloids in liquid crystals [1, 2], electrophoresis of charged colloids [4, 5], particle diffusion in fluids [7, 8], dispersion rheology [9, 11], tumbling chain in shear flow [10], and particle sedimentation [12]. In 2006, we released KAPSEL, free software for direct numerical simulations of particle dispersions implementing SPM. The latest version KAPSEL-2 is available now [12].

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