Sedimentation of particles in Stokes flow

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We consider the sedimentation of N identical spherical particles in a uniform gravitational field. Particle rotation is included in the model while fluid and particle inertia is neglected.
In the dilute case *i.e.* when the minimal distance is much larger than $N^{-1/3}$, the result in [5] shows that there is no interaction between particles and that the dilute regime is preserved in finite time. When the minimal distance is of order $N^{-1/3}$, the control of the minimal distance is proved in [4]. Moreover, the author provides a rigorous convergence of the dynamics to the solution of a fluid-kinetic equation which is an inertialess version of the Vlasov-Stokes model.
In this paper, using the method of reflections, we extend the investigation of [4] by discussing the threshold beyond which the minimal particle distance is conserved in a finite time interval. The set of particle configurations considered herein is based on the one introduced in [3] for the analysis of the homogenization of the Stokes equation. We also prove that the particles interact with a singular interaction force given by the Oseen tensor and justify the mean field approximation in the spirit of [1] and [2].

Références

[1] M. Hauray, *Wasserstein distances for vortices approximation of Euler-type equations*, Math. Models Methods Appl. Sci. 19, [1357,1384], 2009.

[2] M. Hauray, P. E. Jabin, *Particle approximation of Vlasov equations with singular forces: propagation of chaos*, Ann. Sci. Éc. Norm. Supér. (4), 48(4):[891-940], 2015.

[3] M. Hillairet, *On the homogenization of the Stokes problem in a perforated domain*, Arch Rational Mech Anal, 230, [1179,1228], 2018.

[4] R. M. Höfer, *Sedimentation of Inertialess Particles in Stokes Flows*, Commun. Math. Phys. 360, [55,101], 2018.

[5] P. E Jabin, F. Otto, *Identification of the dilute regime in particle sedimentation*, Communications in Mathematical Physics, 2004.

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