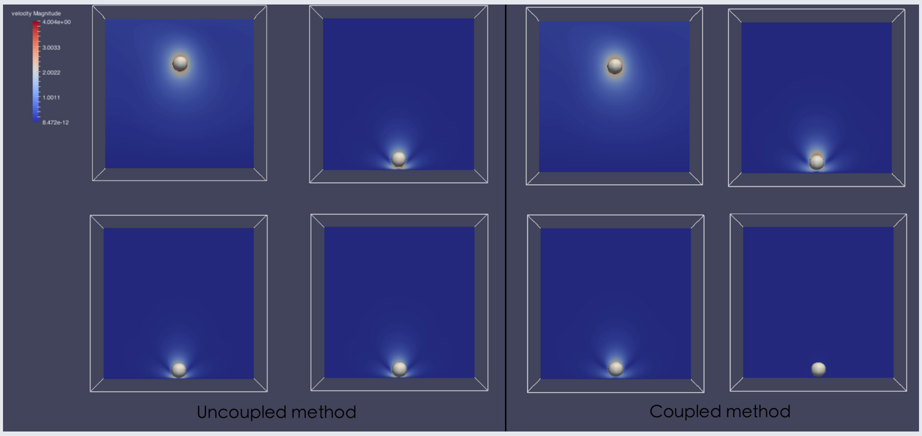
What is the role of interphase stress in the behavior of macroscopic dispersion?

A. Lefebvre-Lepot, B. Merlet (CMAP, Ecole Polytechnique), L. Gouarin (LMO, UPSud) and G. Gauthier (FAST, UPSud)

In 2011, Nott *et al.* put in light the existence of an interphase stress which may account for the shear induced migration observed in the flow of low Reynolds number macroscopic suspensions. However, this interphase stress can't be measured experimentally neither numerically using the classical model. Indeed, most of the fluid-particle solvers are based on a splitting method between the close interaction models and the fluid solver. In these simulations, no feedback is exerted on the fluid which prevents the computation of quantities of interest which are linked to the velocity or pressure fields. The numerical method developed by A. Lefebvre-Lepot is based on an explicit expansion of the velocity and pressure lubrication fields. Doing so, short ranges interactions are propagated to the whole flow, including many-body lubrication effects. Moreover, the velocity and pressure fields are corrected, which allows us to compute accurately macroscopic quantities such as grid pressure, and study the contribution of many body interactions to suspension non-Newtonian properties.



The figure shows the evolution of the fluid flow velocity due to the sedimentation of a unique sphere using two methods of simulation. While the particle is far from the wall the fluid flow is independent of the method used, but as the particle approaches the wall, flows differ. Moreover, with the uncoupled method a flow still exists once the particle is at rest on the bottom wall. This illustrates the importance of a precise simulation of the lubrication forces when particles are close to each other, in order to achieve accurate simulations and to study the interphase force.

P.R. Nott, E. Guazzelli,O. Pouliquen, "*The suspension balance model revisited.*" Physics of Fluids, 23:043304, (2011)

A. Lefebvre Lepot, G. Chivot, M. Girardin, L. Gouarin and B. Merlet, "*An accurate method to take into account lubrication forces in numerical simulations of suspensions.*", 9th International Congress of Multiphase Flow, Firenze, Italy, May 22 - 27, (2016)

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