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OpenFOAM Research Migration Project
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Numerical simulation of breakup of a viscous drop in simple shear flow through a volume-of-fluid method

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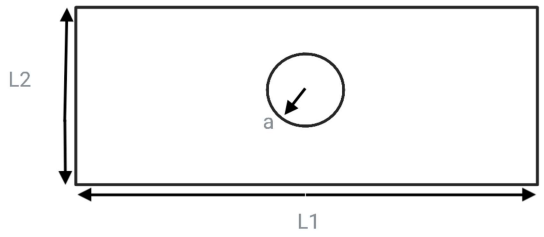
Synopsis

This research migration project aims to do numerical simulations of the deformation experienced by a spherical drop placed in a viscous fluid when a shear rate is applied on parallel plates. The flow is investigated through a volume-of-fluid (VOF) method. The three dimensional case has been simulated using OpenFOAM. The scheme incorporates a semi-implicit Stokes solver (interFoam) to perform the transient analysis at low Reynolds number. The solver is PIMPLE algorithm-based. The geometry and mesh were defined using blockMesh utility. Simulation results were obtained by changing various parameters for validating the results in the paper. The analysis executed by Jie Li, Yuriko Y. Renardy, and Michael Renardy [1] using numerical analysis utilising the projection method and three-dimensional semi-implicit scheme is taken as a reference.
The dimensions of the geometry stated in figure 1 are: $L1 = 3m, L2 = 2m, Thickness = 1m$ and $a = 0.25m$. The spherical drop is in the centre of the cuboidal box and the top and bottom plates of the domain have a shear rate $\dot{\gamma}$. Fluid properties and boundary conditions are discussed in the report.



References

[1] Jie Li, Yuriko Y. Renardy, and Michael Renardy. “Numerical simulation of breakup of a viscous drop in simple shear flow through a volume-of-fluid method.” In: Physics of Fluids (1994-present) 12, 269 (2000); DOI: http://dx.doi.org/10.1063/1.870305