Influence of surfactants on the breakup of a bubble in rotating flows

Laboratory : Institut Lumiere Matiere
In Cooperation With : Laboratoire de Mécanique des Fluides et d'Acoustique
Level : M1
Team(s) : Liquides et interfaces (A.L.BIANCE/ C. COTTIN-BIZONNE)

Contact(s) : LE MERRER Marie
DETCHEVERRY François
MEZACHE Yedhir
BIANCE Anne-laure

Contact(s) Details: marie.le-merrer@univ-lyon1.fr / Tel. 0472448570
francois.detcheverry@univ-lyon1.fr / Tel. 0472431025
yedhir.mezache@univ-lyon1.fr /
anne-laure.biance@univ-lyon1.fr / Tel. 0472448228

Keyword(s) : two-phase flows / surfactants / levelset

Scientific Context :

Flows involving the fragmentation of bubbles or droplets immersed in a surrounding liquid play an important role in a wealth of industrial and environmental settings. Promoting breakup may be important for efficiency, such as in combustion, cooling, or for controlling sprays in coating agent/pesticide delivery. Conversely, one may want to suppress the breakup mechanism, for example, when generating liquid foams to be used in firefighting, cosmetics, or as precursors for making lightweight insulating materials in the construction industry.

The deformation and conditions for breakup of these bubbles or droplets is determined by mechanical properties of interfaces that separate them from the surrounding liquid. Moreover, these interfaces almost always contain a layer of surfactants (e.g. soap), which generally lower the local surface tension.

These surfactants, thus, play an integral role in deformation and eventual breakup of bubbles and droplets. However, a full description of the evolution of the surfactant distribution and its influence on surface deformation and eventual breakup is difficult to obtain experimentally. Therefore, numerical simulations are used to complement this investigation, in collaboration with Peter Spelt (Laboratoire de Mécanique des Fluides et d'Acoustique) in the context of the ANR project "Surfbreak".

Missions :

The goal of this internship is to investigate the influence of surfactants on fragmentation at the bubble scale. The intern will be executing an in-house code to simulate a single bubble in a liquid undergoing a rotational flow. By exploring a range of parameters characterizing surfactant transport, the aim is to identify conditions for breakup. Ideally, the intern will have an inclination towards fluid mechanics and computational physics.

Outlooks :

Numerical results will be compared to experiments run by collaborators in LMFA.

published on 26 mars 2020