Institut de Mécanique des Fluides
2 Allée du Pr Camille Soula, Toulouse

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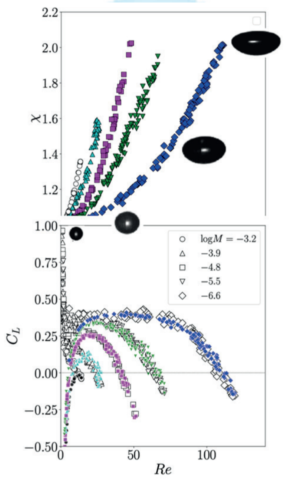
Vendredi 13 septembre à 14 h 00 • Amphithéâtre Nougaro

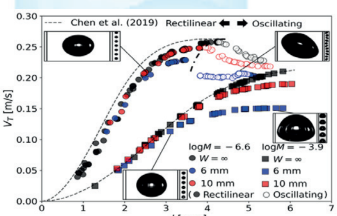
Bubbles freely rising in liquid and under geometric constraint

This seminar will bring some discussion on motion of single bubbles freely rising in liquid and under some geometric constraint.



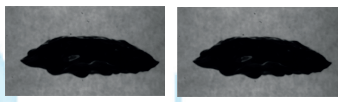
-Shape and drag correlations of ellipsoidal bubbles in viscous liquids: its application to lift reversal modeling

The reversal of the sign of lift coefficient has been discussed so far in literature from Kariyasaki (JSME, 1987), and Adoua et al. (JFM, 2009) pointed out that the vorticity produced at the bubble surface dominates the lift reversal under weak shear. On the other hand, Legendre (2007) showed that the drag force acting on spherical/ellipsoidal bubbles in uniform flow can be simply expressed in terms of the maximum surface vorticity. These facts inspired us to establish a lift correlation by connecting the surface vorticity and the lift via the drag. A shape and a drag correlation of ellipsoidal bubbles in viscous liquid are first introduced and then they will be used as the basis of the lift force modeling. [References: Aoyama et al., IJMF 79, 23-30 (2016); Chen et al., MST 31, 215-234 (2019); Hayashi et al., IJMF 129 103350 (2020); Hayashi et al., IJMF 142 103653 (2021)]



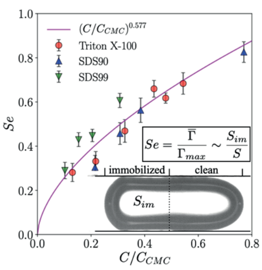
-Deformed bubbles in parallel flat plates

Figueroa-Espinoza et al. (JFM, 2008) revealed the wall effects on the drag and oscillating motion of small bubbles rising through liquid between parallel flat plates. The path oscillation in the direction normal to the wall was caused by wall-induced (attractive) lift though the bubbles would not show oscillating behavior if they were in infinite stagnant liquid. In this part, some experimental and numerical results for larger bubble sizes, for which bubbles exhibit path oscillation even without plates, extending our understanding of the wall effects on the drag, the bubble shape (aspect ratio) and the onset of path oscillation.



-Cap bubbles in fiber bundles

Bubbles rising through rod bundles have been studied in literature mainly in the nuclear engineering field; the rod diameter is usually much larger than the gap between the rods. Experimental results of cap bubbles through fiber bundles in square-arrangement will be presented in the talk; the fiber diameter was 2 mm as observed in a water treatment process like MBR while the fiber pitch was several millimeters. The presence of fibers largely affected the bubble shape and the lateral migration was limited, resulting in an increase in rise velocity, which can be correlated in terms of the pitch/bubble diameter. [Reference: Kurimoto et al., CES 299 120557 (2024)]



-Surfactant-laden Taylor bubbles in square microchannel

This part presents the surfactant coverage of the bubble interface in Taylor flows, which were formed in a 200 µm square channel with water contaminated by Triton X-100/SDS. Taylor bubbles exhibit changes in the liquid film thickness depending on the bulk surfactant concentration, enabling us to estimate the coverage ratio from bubble shapes. The validity of thus obtained surface coverage ratio was examined by comparing it with that measured from the surface tension of the liquid in which the concentration was reduced by foam separation. Surprisingly, the surface coverage ratio was found to be correlated in terms only of the bulk concentration normalized with the critical micelle concentration. [Reference: Mori et al., CHERD 204, 343-353 (2024)

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