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The motion of a clean bubble confined between two vertical walls
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— In nature, as well as in many engineering applications, the effects of confining walls on bubbly flows play an important role. Problems of practical interest where this situation occurs are such as underground water wells and naturally fractured oil reservoirs. Most fundamental studies do not include the effects of walls. The confinement effect on the drag over a bubble was investigated both experimentally and numerically. The experiments were performed with non polar liquids such that the bubble surface could be considered clean. Single bubble experiments and numerical simulations were performed for different Reynolds numbers and dimensionless distances between walls. It was found that the effect of confinement is very strong: the drag can be as much as two times that of a free rising bubble. The comparison between the simulations, performed with the JADIM code, showed good agreement with the experimental results. Both numerical and experimental drag coeficients were found to depend on the dimensionless distance $s = (a/R)$, where a is the bubble radius and R is the distance between walls. The form of this dependency fits closely the form $C_d/C_{d\infty}[1 + 8s^3 + O(s^4)]$. Additionally, it was observed that for large Re the bubble trajectory is unstable, in the sense that it begins to oscillate above certain critical Reynolds; In fact the bubble bounces back and forth from one wall to the other. This instability is different from that observed in freely rising bubbles.

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