BUBBLE DYNAMICS IN LIQUID CROSS FLOW

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Although bubbly flows have been studied for more than 30 years, few efforts have been conducted to quantify the effect of liquid shear flow on bubble formation and travelling. In this project air bubbles were inserted into stagnant water and water with liquid cross flow. The effect of gas flow rate, orifice dimension, liquid column height and velocity of liquid cross flow on the output parameters: bubble dimension, shape and velocity have been studied.

The experimental approach of obtaining these parameters is based on capturing images with a PCO camera and processing the images with a program developed to assist the needs of the investigation. The two different cameras were used with a shadow stroboscopic imaging technique. A theoretical model has been developed in order to predict bubble dimension, velocity and trajectory path.

The results show that the bubble diameter in the dynamic regime increases linearly with the gas flow rate and that bubbles exposed to liquid cross flow has a smaller diameter than the bubbles in stagnant water for the same gas flow rate. Different heights of liquid column proved to have little effect on the bubble dimensions. The results also show that the bubble acceleration time is larger than predicted analytically, due to dynamic effects of gas and liquid inertia as well as up draught effect from wake of the previous bubble. The acceleration gives the bubble a maximum velocity, which decelerates to the terminal velocity in a short time after detachment. Bubbles captured close to the orifice had a higher velocity than what was theoretically predicted and the velocity increased with increasing bubble volume.

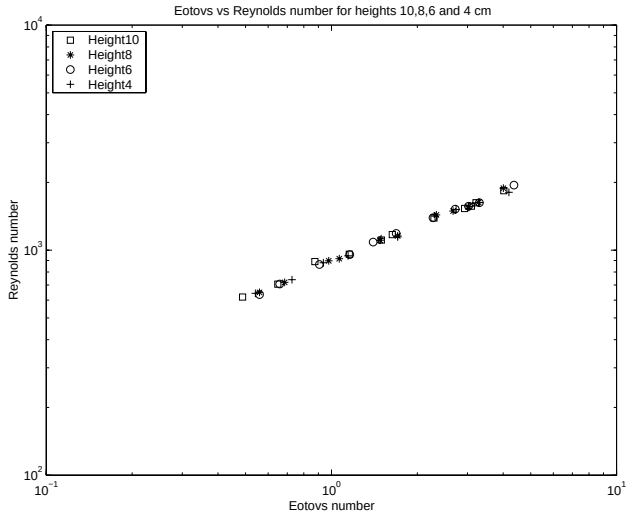

Figure 1: Bubble velocity and diameter plotted non dimensionally, orifice diameter 1 [mm], height of liquid column 10,8,6 & 4 cm