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A robust image analysis approach for high void fraction gas-liquid flows

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Bubbly flows occur frequently in natural systems and are also used for different applications in petroleum, energy-producing and chemical industries. The measurements of bubble size distribution are thus crucial in many applications in chemical engineering, viz. Hydrogenation of unsaturated oil, coal liquefaction, fermentation, waste water treatment, floatation cells, aeration studies, spargers etc. The conventional methods using image analysis to measure bubble size are limited in their robustness and applicability in dense or highly turbulent bubbly flows. These flow situations usually impose many challenges for image processing such as a wide range of bubble size distribution, spatial and temporal inhomogeneity of image background including in-focus and out-of-focus bubbles and excessive concentration of bubble clusters. This presentation introduces a multi-level image analysis approach to detect a wide size range of bubbles and resolve bubble clusters from images obtained in a turbulent bubbly wake of a ventilated hydrofoil. The proposed approach was implemented to derive bubble size and air ventilation rate from the digital images and the experimental measurements, respectively. The results show a great promise in its applicability for online monitoring of bubbly flows in a number of industrial applications.

Biography

Ashish Karn is a PhD Candidate at the St. Anthony Falls Laboratory and Department of Mechanical Engineering, University of Minnesota Twin Cities (UMTC). He has done his bachelors and masters from Indian Institute of Technology Delhi and UMTC, respectively, both in Mechanical Engineering. He works in the area of multiphase flows, cavitation and supercavitation.

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