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Multi-layered bubble detection in an air-water two-phase flow

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Multiphase flow systems, usually a flow system involving multiple phases, are and have been for decades a phenomenon of particular interest to researchers and scientists globally. This is due to the extensive application of such systems in the physical, chemical, biomedical and petrochemical industries. In the nuclear power industry, accurate prediction of transient phenomenon occurring in the reactor core, primary and secondary loops largely involving two-phase flows is paramount for safety analysis and control. The safety system analysis codes used employ the two-fluid model which treats the thermal hydraulic properties of each fluid separately and couples both systems by the introduction of interfacial transfer terms. Understanding of interfacial structures and deducing the interfacial area concentration leads to correct modeling of the interfacial terms. Since bubbles play a significant role in a two-phase flow thermal-hydraulics properties, the effects of bubble formation and growth on flow properties or system performance cannot be overemphasized. This work therefore introduces an algorithm for detecting bubbles in a two-phase flow using a multiple thresholding approach to detect bubbles in layers based on pixel intensity stemming from their relative distance away from the capturing source. Parameters from the detected bubbles serves as the bedrock for the deduction of other secondary parameters needed to accurately deduce the interfacial area concentration and hence the interfacial transfer terms.

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