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Investigation of Bubble Growth During Nucleate Boiling Using CFD

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Abstract : Boiling process is characterized by the rapid formation of vapour bubbles at the solid–liquid interface (nucleate boiling) with pre-existing vapour or gas pockets. Computational fluid dynamics (CFD) is an important tool to study bubble dynamics. In the present study, CFD simulation has been carried out to determine the bubble detachment diameter and its terminal velocity. Volume of fluid method is used to model the bubble and the surrounding by solving single set of momentum equations and tracking the volume fraction of each of the fluids throughout the domain. In the simulation, bubble is generated by allowing water-vapour to enter a cylinder filled with liquid water through an inlet at the bottom. After the bubble is fully formed, the bubble detaches from the surface and rises up during which the bubble accelerates due to the net balance between buoyancy force and viscous drag. Finally when these forces exactly balance each other, it attains a constant terminal velocity. The bubble detachment diameter and the terminal velocity of the bubble are captured by the monitor function provided in FLUENT. The detachment diameter and the terminal velocity obtained is compared with the established results based on the shape of the bubble. A good agreement is obtained between the results obtained from simulation and the equations in comparison with the established results.

Keywords : bubble growth, computational fluid dynamics, detachment diameter, terminal velocity
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