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Verification and validation of a GPU-based multi-resolution direct numerical simulation of multiphase flow with phase change CHRISTOPHER J. FORSTER, MARC K. SMITH, Georgia Institute of Technology — Nucleate boiling processes span a large range of length scales, ranging from O(1 μm) to O(0.1 m), that arise due to steep gradients in the density and temperature near the liquid-vapor interface and the contact line. The Wavelet Adaptive Multiresolution Representation (WAMR) method is a general and robust technique for providing grid adaptivity around sharp features in the solutions of partial differential equations and is capable of resolving the large disparity of length scales present in nucleate boiling. A new flow solver based on the WAMR method and specifically parallelized for a GPU computing architecture has been developed. The compressible formulation of the Navier-Stokes equations is used in the flow solver and a preconditioned dual time-stepping integration scheme provides accurate solutions for flows approaching the incompressible limit. The WAMR method provides a direct measure of the local error over the entire grid and coupling spatial error control with adaptive time integration allows for *a priori* control of the error in the solution. Verification and validation cases, including single vapor bubble growth, will be presented to demonstrate the efficiency and accuracy of the method for solving nucleate boiling problems.

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