ABSTRACT

The current research is focused on developing a well-posed two-fluid model (TFM) for bubbly flows. The TFM is derived from first principles and it can be applied to a wide range of flow configurations from horizontal stratified flows to vertical annular flows. The TFM used in numerical codes can be shown to have complex eigenvalues, which results from the ill-posed nature of the implemented incomplete models. It is a common practice to regularize the model by adding artificial physics or numerically by using a coarse mesh or first order methods to avoid non-physical high frequency oscillations in the solution. However, this removes the local physical instabilities that are inherently captured by the TFM. The method adopted here is to add appropriate physics to make the model well-posed. The approach is extended to a 3-D TFM using a higher order numerical scheme which is verified by the method of manufactured solutions. The results indicate limit cycle behavior for a coarse grid and chaos for finer grids, the latter being characteristic of turbulent bubbly flows. A grid convergence test is performed using the FFT spectra since the solutions are chaotic. Thus, using a well-posed TFM, the limit on grid refinement is removed, which has been a restriction in the past.

BIOGRAPHICA

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