Numerical Stability Analysis and Evaluation of Stability Enhancing Interfacial Pressure Force Model

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Abstract

In order to overcome the ill-posedness of a typical two-fluid model, a hyperbolic equation system has been developed by introducing an interfacial pressure force in phasic momentum equations. The interfacial pressure force for the present model is derived by characteristic analysis under the assumption of isentropic compressible flow condition. The potential impact of the present model on numerical stability has been examined by Von-Neumann stability analysis. The obvious improvement in numerical stability has been found when a semi-implicit time advancement scheme with implicit treatment of the interfacial pressure force term is used. Numerical experiments using the pilot code have also been shown that the propagation of void wave perturbation and the water faucet flow are well predicted without distortion.