SOUND, SHOCK, EXPANSION AND VOID WAVES IN TWO-PHASE FLOW PREDICTED BY HLL SCHEME WITH INTERFACIAL FRICTION TERMS

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Wave propagatiosn in the two-phase flows have been numerically investigated. Various waves have been generated by means of hydrodynamic shock tube, and a pair of anti-symmetric rarefaction pulse, pressure pulse and void pulse waves. The six compressible two-fluid two-phase conservation laws with the interfacial friction terms have been solved numerically in the split fractional steps. The first main-operator step solves Euler equations by HLL scheme using the analytic eigenvalues of an approximate Jacobian matrix. The second source-operator step solves the ordinary differential equations by means of the stiff ODE solver in a semi-implicit form. The composite sonic speeds in the two-phase flow calculated by the present method are well compared with the existing data obtained by other numerical models and experiments. The various waves in the two-phase flow field that we have resolved by the present method, such as shock wave, rarefaction wave, void wave, density and velocity waves, have showed very small numerical diffusion in comparison with other numerical method. By comparing the numerical results obtained with and without the interfacial friction terms, we have been able to assess the effect of the interfacial friction source terms that are included in the momentum equations.