Extension of the entropy viscosity method to the multi-D 7-equation two-phase flow model. I do not know if we should have 'multi-D' in the title since we will only present 1-D results

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Abstract

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Key words: two-phase flow model, with variable area, entropy viscosity method, stabilization method, low Mach regime, shocks.

1. Introduction

- a few lines about the need for accurately resolving two-phase flows
- background on the different two-phase flow models: 5, 6 and 7-equation two-phase flow models
- then, focus on the different types of 7-equation two-phase flow models: they mostly differ because of the closure relaxations used
- discuss the different numerical solvers developed for the 7-equation two-phase flow model: HLL, HLLC, and approximated Riemann solvers accounting for the source terms
- emphasize the fact that the above numerical solvers only works on discontinuous schemes
- then, introduce the entropy viscosity method and details the organization of the paper

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2. The multi-D 7-equation two-phase flow model

- give the equations and detail the different terms
- include the relaxation terms, the mass and heat exchange terms
- eigenvalues
- entropy equation WITHOUT the dissipative terms and five the details of the derivation in the appendix

3. A viscous regularization for the multi-D 7-equation two-phase flow model

- explain why we work with the phase entropy equation instead of considering the total entropy residual by summing over the two phases
- viscous regularization must be consistent with single-phase flow equation
- recall the notion of entropy condition and entropy inequality $\rightarrow$ require dissipative terms in order to get a sign
- give the system of equations with the dissipative terms
- guide the reader through the derivation of the dissipative terms
- give the entropy residual with all terms in the right hand-side
- make the link with the single-phase flow equations
- explain how to derive the dissipative term for the volume fraction equation
- emphasizes the fact that the regularization is valid for any EOS with convex entropy
- a few words about the parabolic regularization

4. A definition of the viscosity coefficients for all Mach flows

- non-dimensionalize the equations but use P_∞ for the pressure instead of $(\rho c^2)_\infty$
- introduce a new Pechlet number for β: its behavior should be the same as the Pechlet number for κ
- two cases: zero and infinite relaxation coefficients
- derive the normalization parameters for the isentropic and non-isentropic flows
- discussion about the

5. 1-D numerical results

- simple advection problem
- shock tube with two independent fluids: exact solution and could do convergence test for this particular test
- shock tube with infinite relaxation coefficients
- 1-D nozzle with two independent fluids
- 1-D nozzle with infinite relaxation coefficients
- 1-D nozzle with infinite relaxation coefficients, mass and heat transfer