Abstract Submitted
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Modeling and simulation of N-phase-M-component incompressible flows[1] ZIYANG HUANG, GUANG LIN, AREZOO ARDEKANI, Purdue University — A consistent and conservative model is proposed for N-phase-M-component incompressible flows, where N (N1) and M (M0) are the numbers of phases and components, respectively. Phases are immiscible with each other, while components are dissolvable in given phases. Several consistency conditions are proposed for multiphase and multicomponent flows to avoid unphysical behaviors, e.g., incompatibility between the mass and momentum equations, generating fictitious phases, local void, or overfilling, and leakage of components at phase boundaries. The mass of individual phases, the amount of each component, and the momentum of the fluid mixture are conserved by the proposed model. The model also satisfies the 2nd law of thermodynamics and Galilean invariance. A 2nd-order scheme is developed, which preserves the consistency and conservation properties of the model, and the numerical solution is demonstrated to preserve the Galilean invariance and energy law. Various challenging multiphase and multicomponent flows, including large density and/or viscosity ratios, can be effectively studied by using the proposed model and scheme. The proposed model and scheme are also applicable for multiphase problems where different phases have different miscibility with each other.

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Ziyang Huang
Purdue University

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