NUMERICAL MODELING OF CONTACT DISCONTINUITIES IN TWO-PHASE FLOW

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ABSTRACT

For convection dominated two-phase flow, velocity components tangential to the interface can become discontinuous when interface boundary layers are numerically underresolved. When sharp interface tracking methods are used it is essential that such discontinuities are captured in an equally sharp way.

In this paper we propose to model the velocity component tangential to the interface as discontinuous using an appropriate interface jump condition on the normal component of the pressure gradient. We achieve this numerically using a novel combination of a Multi-dimensional Ghost Fluid Method for the gradient and the Cut Cell Method for the divergence operator. The resulting model is able to accurately and sharply capture discontinuities at large density ratios.

The model is applied to an inviscid dam-break problem. Here we observe that our proposed model accurately captures the shear layer at the interface with the tangential velocity discontinuity.

In future work we will apply this discretization approach to the modeling of viscous two-phase sloshing problems with LNG and its compressible vapour, with a particular interest in studying the development of free surface instabilities.

References

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