

A posteriori MOOD limiting approach for multicomponent flows on unstructured meshes

P. Tsoutsanis¹, P. S. Farmakis²

¹ Cranfield University, College Road, MK430AL, UK,
panagiotis.tsoutsanis@cranfield.ac.uk

² Laboratory for Laser Energetics, University of Rochester, NY, 14623, USA,
pfar@lle.rochester.edu

Keywords: *Multiphysics Problems, High-Order, Finite-Volume, MOOD, Unstructured*

In this work we present the extension of a relaxed multidimensional optimal order detection (MOOD) algorithm [3] to multicomponent flows using unstructured meshes. In particular the diffused interface method is employed [5] using the Allaire 5 equation model [4] and the stiffened equation of state. High-order linear and non-linear methods are deployed, and all the methods and algorithms are implemented in the open-source ucns3d CFD code [6].

The performance of several numerical methods is assessed in terms of accuracy, non-oscillatory behaviour and computational cost. The primary aim is to reduce the computational footprint of the MOOD algorithm, by tuning the numerical admissible detection criteria for solutions, and selecting primitive or characteristic variable reconstruction. Several stringent test problems are employed such as shock wave interaction with bubbles, multicomponent shock tube problems, and multiple types of instabilities.

REFERENCES

- [1] P. Farmakis, P. Tsoutsanis, X. Nogueira, *WENO schemes on unstructured meshes using a relaxed a posteriori MOOD limiting approach*, Computer Methods in Applied Mechanics and Engineering 363 (2020). doi:10.1016/j.cma.2020.112921.
- [2] G. Allaire, S. Clerc, S. Kokh, *A five-equation model for the simulation of interfaces between compressible fluids*, Journal of Computational Physics 181 (2) (2002) 577–616. doi:10.1006/jcph.2002.7143.
- [3] P. Tsoutsanis, E. M. Adebayo, A. Carriba Merino, A. Perez Arjona, M. Skote, *CWENO finite-volume interface capturing schemes for multicomponent flows using unstructured meshes*, Journal of Scientific Computing 89 (2021). doi:10.1007/s10915-021-01673-y.
- [4] P. Tsoutsanis, A. Antoniadis, K. Jenkins, *Improvement of the computational performance of a parallel unstructured WENO finite volume CFD code for implicit large eddy simulation*, Computers and Fluids 173 (2018) 157–170. doi:10.1016/j.compfluid.2018.03.012.