Aerospace Europe Conference 2023
Joint 10th EUCASS – 9th CEAS Conference

Abstract #XXX *(to be filled by the organizers)*
Preferred Topics: CFDMPS
Corresponding author: DI MATTEO Mariano
e-mail of corresponding author: Mariano.Di.Matteo@ulb.be
Type: Oral
Status or corresponding author: Student
For student corresponding author: student member of one of the following:
3AF / AAAR / AIAE / AIDAA / CzAeS / DGLR / FTF / NVvL / PSAA / RAeS / SVFW / EUROAVIA

Title

VoF-to-DPM 3D Model for non-reacting gas-liquid two-phase flow characterization

Authors

Mariano DI MATTEO [1], Olivier Berten [1], Patrick Hendrick [1]*

** Corresponding author*
[1] Université libre de Bruxelles – Aero-Thermo-Mechanic Department, 1050 BRUSSELS, Belgium,
Mariano.Di.Matteo@ulb.be , Olivier.Berten@ulb.be , Patrick.Hendrick@ulb.be

Abstract

The characterization of gas-liquid two-phase flow is essential in a variety of engineering fields. Ranging from chemical process to energy conversion and environmental system, characterize accurately the dynamic of these flows is essential for the design and optimization of processes.

One common approach to model these fluids is the Lagrangian-Eulerian method for the simulation of dispersed two-phase flows [1]. However, the Lagrangian method is complex to apply in the presence of large interface and geometrical changes, therefore these problems are modelled with Eulerian methods [2]. Among these methods the Volume of Fluid (VOF) method is widley used due to its robustness and its ability to track the interface between liquid and gas phases. The VOF model has some limitations, one of which is its inability to accurately predict the behavior of disperse phases, such as liquid droplets. One way to address this limitation is to use a coupled Volume of Fluid (VOF) and Discrete Phase Model (DPM), with the aim of combining the benefits of both analytical formulations.

In this study, we investigate the feasibility of characterizing non-reacting gas-liquid two-phase flow using a 3D VOF-to-DPM model. The model combines the VOF and DPM models to simulate the interaction between the dispersed and continuous phases and account for the various physical phenomena involved.

To validate the proposed model, numerical simulations are performed for a range of flow conditions, and the results are compared with experimental data [3]. The model is verified by qualitatively comparing its prediction with reference solutions.

References

[1] R. Garg, C. Narayanan and S. Subramaniam, "A numerically convergent Lagrangian-Eulerian simulation methods for dispersed two-phase flows," no. 35, 2009.

[2] D. A. Hoang, V. van Steijn, L. M. Portela, M. T. Kreutzer and C. R. Klleijn, "Benchmark numerical simulations of segmented two-phase flows in microchannels using the Volume of Fluid method," *Computers & Fluids,* no. 86, pp. 28-36, 2013.

[3] M. Di Matteo, O. Berten, B. Fulleringer and P. Hendrick, "Experimental characterization of air-oill two phase flow and air -oil separator performance in advanced aero-engines," in *ISABE 2019*, Camberra, 2019.