A modelling and numerical approach for describing statistical trajectory crossing in polydisperse sprays

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High fidelity modeling and simulation of turbulent dispersed two-phase flows is still a major challenge for many applications. Eulerian approaches are well suited for high performance computations of such flows. Recently, hybrid Eulerian methods that combine the multi-fluid method - where the size is discretized - and the moment method were developed. On the one side, in order to capture efficiently the size polydispersion, two moments were used on each interval of the size discretization [2]. On the other side, the Anisotropic Gaussian velocity closure [3] has been introduced as a relevant model to describe velocity dispersion occurring when the particles from the disperse phase have a significant inertia compared to the time scales of the flow, leading to particle trajectory crossings. The purpose of this contribution is to develop a model able to describe both size and velocity dispersion, coupling the two-size moment Eulerian multi-fluid method and the anisotropic velocity closure. Adapted numerical schemes based on a relaxation method are provided [1]. This new model is then evaluated on various test cases relevant to solid propulsion and two-phase combustion.

Références

[1] M. Boileau, C. Chalons, M. Massot, *Robust numerical coupling of pressure and pressureless gas dynamics equations for Eulerian spray DNS and LES*, SIAM SISC, Vol. 37, No. 1 (2015) B79-B102

[2] F. Laurent, A. Sibra, F. Doisneau, *Two-size moment multi-fluid model: a robust and high-fidelity description of polydisperse moderately dense evaporating sprays*, Communications in Computational Physics, accepted (2016) 1-41

[3] A. Vié, F. Doisneau, M. Massot, *On the Anisotropic Gaussian closure for the prediction of inertial-particle laden flows*, Communications in Computational Physics, Vol 17, No. 1 (2015) 1-46

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