6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
1115 June 2018, Glasgow, UK

BAG MODE BREAKUP SIMULATIONS OF A SINGLE LIQUID DROPLET

César Pairetti[1], Stéphane Popinet[2], Santiago Márquez Damián[3], Norberto Nigro[4] and Stéphane Zaleski[5]

[1] Facultad de Ciencias Exactas, Ingeniería y Agrimensura (UNR-CONICET), Beruti 2109 Rosario (2000), Argentina; pairetti@fceia.unr.edu.ar, http://web.fceia.unr.edu.ar

[2] Sorbonne Université, CNRS, Institut Jean Le Rond d'Alembert; 4 Place Jussieu 75252 Paris CEDEX 05, France; stephane.popinet@sorbonne-universite.fr; http://www.dalembert.upmc.fr

[3] Centro de Investigación de Métodos Computacionales (UNL-CONICET) Ruta Nacional 168 (km 0), Santa Fe, Argentina; santiagomarquezd@gmail.com; http://www.cimec.org.ar

[4] Centro de Investigación de Métodos Computacionales (UNL-CONICET) Ruta Nacional 168 (km 0), Santa Fe, Argentina; nnigro@santafe-conicet.gov.ar; http://www.cimec.org.ar

[5] Sorbonne Université, CNRS, Institut Jean Le Rond d'Alembert; 4 Place Jussieu 75252 Paris CEDEX 05, France; stephane.zaleski@sorbonne-universite.fr; http://www.dalembert.upmc.fr

Key words: Droplet, Bag-mode, Breakup, Volume of Fluid

Abstract. Aerodynamic breakup (aerobreakup) consist on the decomposition of liquid bulks into smaller droplets due to the effect of a gas stream. Depending on the flow parameters, a liquid drop affected by a gas stream can evolve in several aerobreakup modes.In particular, bag mode breakup takes place at moderate to low gas Weber numbers. During this process, the drops deforms into a film with a bag shape. As the bag radius increases, the film thickness decreases until a hole forms and expands, bursting the bag into a spray. This mechanism is present in several breakup scenarios and it is of great interest to understand the underlying physics of liquid atomization.

In this work, we present numerical simulations of a single droplet submerged in a stream with sets of parameters corresponding to bag mode breakup regime. We solve Navier-Stokes equations for the two-phase flow using a Volume of Fluid (VOF) method with a Piecewise Linear Interface Capturing (PLIC) and geometrical advection schemes on the volume fraction and momentum equations. We also apply Adaptive Mesh Refinement (AMR) to reduce the computational cost, using high mesh resolution only in the region of interest. These tools are programmed in the Basilisk open-source suite (http://basilisk.fr/).The deformation of the drop into a film and the posterior evolution of its thickness is studied until the formation of a hole.