Numerical computation of Navier-Stokes two-phase flows: Recent advances for strong stresses and open boundary conditions

Angot Philippe *
Aix-Marseille Université, France
philippe.angot@univ-amu.fr

Abstract

This lecture presents recent advances for the efficient computation of Navier-Stokes multiphase flows. In particular, the vector penalty-projection splitting methods including the so-called kinematic version are detailed. The space discretization is made by finite volumes on the Cartesian MAC grid or with edge-based generalized MAC-type unstructured meshes. Moreover, an accurate Lagrangian front-tracking method is proposed. This family of numerical splitting methods is especially designed for the cases with large density/viscosity ratios, large surface tension and open boundary conditions expressed with the stress vector. Several sharp benchmark problems are solved such as the free fall of a heavy rigid ball in air (with a density ratio of 10^6) or air-bubble dynamics in a melted steel with a density ratio of 10^4 and strong capillary forces.