Simulation & modeling of bubbles in vortex–dominated flows

MICHAEL MATTSON, PRADEEP BABU, KRISHNAN MAHESH, University of Minnesota — Bubbles in vortex–dominated flows occur widely; e.g. turbulent shear layers, free jets, and tip vortex cavitation in propellers. Two problems are considered here: (i) bubbles entrained into the core of a line vortex and (ii) bubbles entrained into the core of a ring vortex. Two different computational approaches are used: (i) Lagrangian models for the bubble dynamics coupled with direct numerical simulations of the flow field, and (ii) direct simulation of two–phase gas/water bubbles using a front tracking method coupled with the Navier–Stokes equation for the external flow. The Euler–Lagrange simulations assume one–way coupling with non–cavitation nuclei. The talk will discuss the process of entrainment of the bubbles by the vortices, and use the front–tracking simulation results to discuss validity of the model equations used in the Euler–Lagrange simulations.

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Date submitted: 03 Aug 2006   Electronic form version 1.4