FM8S_12547

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Entrainment of Air Bubbles During Strong Vorticity-Free-Surface Interaction

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The air entraiment induced by vorticity–free-surface interaction is here numerically investigated with the help of a two-fluid model which describes the flow in air and water as that of a single incompressible fluid whose density and viscosity vary smoothly across the interface. The numerical approach is used for the simulation of a viscous vortex pair vertically rising toward the free surface and comparisons are established with results available in literature obtained by boundary-fitted numerical approach. A validation of the model is carried out in a mild vorticity–free-surface interaction and a rather good agreement is achieved. For a stronger interaction, air entrainment is found, in contrast with available results. A deeper verification is undertaken aimed at understanding the reasons for such disagreement.

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