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Two-way Interaction of Lagrangian Bubble Dynamics and Eulerian Mixture Flow Field[1] JIN-KEUN CHOI, CHAO-TSUNG HSIAO, GEORGES CHAHINE, Dynaflow, Inc., DYNAFLOW, INC. TEAM — Although under simple flow conditions a well dispersed bubble cloud in a liquid can be modeled with an Eulerian continuum model, the fine scale interactions between the two phases, the potential non-uniformities and high bubble concentrations in stiff gradient regions of complex flows can only be represented by more detailed numerical models such as Lagrangian tracking of individual bubbles. To meet both needs of describing individual bubbles and of including the collective effects in the two-phase continuum, we have developed a method coupling in a two-way fashion the two approaches. The bubble dynamics and tracking scheme is based on extensive studies on bubble dynamics and interactions at DYNAFLOW and is based on a Surface Averaged Pressure spherical model using a modified incompressible Rayleigh-Plesset equation or a modified compressible Gilmore equation. The bubbles presence in the Eulerian flow field is considered through a variable medium density formulation resulting from the instantaneous bubble population distribution in the field. The developed method is applicable to many practical flows in pipes, jets, pumps, propellers, ships, and the ocean. We present the method and its application to waterjet thrust augmentation by bubble injection.

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