MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
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DIRECT NUMERICAL SIMULATION OF BUBBLE-PARTICLE INTERACTIONS UNDER MICROGRAVITY CONDITIONS

Abstract

The interaction between a deformable bubble and a rigid particle in viscous liquids under microgravity conditions is studied by direct numerical simulation via an arbitrary-Lagrangian-Eulerian(ALE) method. Due to the microgravity, the bubble will stay as a sphere in the fluid without external forces and its deformation is caused by the moving particle. In this study we assume the flow field is axisymmetric and the motion of the gas inside the bubble is neglected. The particle equations and the Navier-Stokes equations for the fluid are solved in a unified finite element framework. The particle obtains an impact velocity by an external force and the impact velocity is varied over a wide range. A 'critical time scale' T_0 was identified for the interaction process. For successful contacts between particle and bubble, the time scale of their relative motion must be less than T_0. The film drainage process and the film thickness between the particle and bubble surface are also studied.