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Multiscale modeling of bubble acoustics[1] SUHAS JAIN, JAVIER URZAY, ALI MANI, PARVIZ MOIN, Center for Turbulence Research — The detection of bubbles and the accurate determination of their sizes is important for several naval applications, including the characterization of ships and submarine wakes. One practical way of accomplishing this task is by using acoustic methods, in which the bubbles are sized using the dependence of their resonance frequency (Minnaert) on their equilibrium radius. In this work, we present a novel compressible diffuse-interface method that accurately captures the interface, maintains favorable characteristics such as boundedness and total-variation diminishing properties for the volume fraction, and is fully non-dissipative and numerically stable. In practical oceanic flows, there is a large separation of scales between the sizes of the bubbles and the corrugation wavelengths of the free surface, and therefore their acoustic scattering behaviors are also different. Taking advantage of this disparity of scales and the resulting scattering behavior, a modeling technique for bubble-size detection is explored where the bubbles are modeled as point scatterers, whereas the free surface is resolved by the diffuse-interface method.

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