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Single deformable bubble interaction with turbulence in uniform and shear flows[1] JINYONG FENG, IGOR BOLOTNOV, North Carolina State University — Combined direct numerical simulation (DNS) and interface tracking method (ITM) approach is utilized to study the effect of bubble deformability on the bubble-induced turbulence. Set of simulations is performed with 5mm diameter bubble in laminar and turbulent flows. Uniform shear and constant mean velocity profiles are used to perform evaluation of bubble-induced turbulence in various cases. The simulation capabilities allow estimating the turbulent kinetic energy before and after the bubble thus providing the information about bubble's influence on the liquid turbulence. The effect of bubble deformability is studied by separately changing the surface tension parameter. The bubble is controlled in one location of the domain using external forces. The force evolution is managed by proportional-integral-derivative (PID) controller. The steady-state values of the lateral and stream-wise forces result in the lift and drag force estimates on the bubble. DNS approach allows for comprehensive, well-defined studies of bubble-induced turbulence and interfacial forces by separately varying bubble's deformability, relative velocity, level of turbulence and local shear. This work presents new opportunities for the development of multiphase computational fluid dynamics closure laws.

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