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Influence of bubbles on liquid turbulence based on the direct numerical simulation of channel flows IGOR BOLOTNOV, DONALD DREW, RICHARD LAHEY, JR., MICHAEL PODOWSKI, Rensselaer Polytechnic Institute, CENTER FOR MULTIPHASE RESEARCH TEAM — It is well known that the bubbles in turbulent flow can modify the structure and intensity of the turbulence. Recent progress in two-phase direct numerical simulation (DNS) provides a new level of detailed information about the two-phase turbulence. The availability of DNS data for single and two-phase turbulent channel flows makes it possible to compute the bubble-induced source terms in the turbulent kinetic energy equation. The turbulent kinetic energy equation, including turbulence production, dissipation and viscous and turbulent diffusion can be derived from the Navier-Stokes equations. Those exact analytical expressions can be applied to the instantaneous pressure and velocity fluctuating fields found in the single and two-phase DNS data to obtain the time-averaged lateral distribution for each term. By analyzing both single-phase and two-phase turbulent channel flows we can estimate the difference in those terms for various gas volume fraction flows. This information can be used to quantify the influence of the bubbles on turbulence in gas-liquid two-phase flows. The results will include an assessment of the currently used models of bubble-induced turbulence, as well as a validation of the new models developed in the current study.

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