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Interfacial Force Model Development for Turbulent Bubbly Flows DILLON SHAVER, IGOR BOLOTNOV, STEVEN ANTAL, MICHAEL PODOWSKI, Rensselaer Polytechnic Institute — Typically, a Reynolds averaged Navier-Stokes (RANS) simulation of turbulent bubbly flows makes use of interfacial force models which represent the interaction between the bubbles and the continuous liquid. The modeled forces include drag, virtual mass, turbulent dispersion, and lift. A direct numerical simulation (DNS) fully resolves turbulent fluctuations in velocity and, when coupled with the level set method, can simulate a two-phase flow without relying on interfacial force models. Results from DNS can provide a level of insight into flow characteristics not easily achievable with traditional experimental methods. This makes DNS ideal for developing interfacial force models for use with RANS codes. Turbulent, air/water, bubbly flows in a channel have been previously simulated using the DNS code, PHASTA. Utilizing the time-averaging concept, average velocities of the two phases, void fraction, turbulent kinetic energy, and turbulence dissipation rate distributions are calculated from the DNS data. This information is then used to develop and calibrate the interfacial force models used in the RANS code, NPHASE-CMFD. Two cases are analyzed. The first is of many small, spherical bubbles of 0.9 mm diameter. The other is of a single, large, cap bubble of 3.625 mm equivalent diameter. Both simulations correspond to the liquid Reynolds number of 11,200, based on the hydraulic diameter.

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