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DNS assisted modeling of bubbly flows in vertical channels[1] GRETAR TRYGGVASON, MING MA, JIACAI LU, University of Notre Dame — The transient motion of bubbly flows, in vertical channels, is studied, using direct numerical simulations (DNS), where every continuum length- and time-scale are resolved. The results of several simulations, starting with laminar or turbulent liquid flows, including one with several hundred bubbles of different sizes and a friction Reynolds number of 500, are reviewed. At statistically steady state, nearly spherical bubbles in upflow form distinct wall-layers, but sufficiently deformable bubbles, as well as bubbles in downflow, do not. The transient evolution, particularly for nearly spherical bubbles in upflow is more complex. The bubbles first move toward the walls and then the liquid slowly slows down, eventually allowing some bubbles to return to the center of the channel. The use of the DNS results to help with modeling the average flow are discussed, including simple analytical models for laminar upflow and downflow and the use of statistical learning and neural networks to relate closure terms to resolved quantities for more complex flows. The prospects of using results from simulations of large system with bubbles of different sizes in turbulent flows for LES-like simulations are explored, including the simplification of the interface structure by filtering.

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