Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

DNS and modeling of bubbly flows in vertical channels[1] MING MA, JIACAI LU, GRETAR TRYGGVASON, University of Notre Dame — The transient motion of bubbly flow, in a vertical channel is studied, using direct numerical simulations (DNS) where every continuum length and time scale is resolved. Nearly spherical bubbles of the same size, injected into laminar upflow, are quickly pushed to the walls due to lift. The velocity then slows down, eventually resulting in some of the bubbles returning to the core forming a mixture where the weight matches the imposed pressure gradient and the void fraction is easily predicted. Unlike the statistically steady state, where the flow structure is relatively simple and in some cases depends only on the sign of the lift coefficient, the transient evolution is more sensitive to the governing parameters. The DNS results are used to provide values for the unresolved closure terms in a simple average model for the flow, found by mining the data, using various techniques such as regression and neural networks. Results for a large number of bubbles of several different sizes in turbulent upflow are also presented and the prospects of using a similar approach for LES-like simulations of more complex flows are discussed, including the simplification of the interface structure resulting from filtering.

[1]Research supported by DOE (CASL) and NSF Grant CBET 1335913.

Jiacai Lu
University of Notre Dame

Date submitted: 01 Aug 2014 Electronic form version 1.4