

Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Three-dimensional simulations of pressure-driven displacement flow of two immiscible liquids using a multiphase Lattice Boltzmann approach PRASANNA R. REDAPANGU, KIRTI CHANDRA SAHU, Indian Institute of Technology Hyderabad, S.P. VANKA, University of Illinois at Urbana-Champaign — A three-dimensional multiphase lattice Boltzmann approach is used to study the pressure-driven displacement flow of two immiscible liquids of different densities and viscosities in an inclined square duct. A three-dimensional-fifteen-velocity (D3Q15) lattice model is used. The simulations are performed on a graphics processing unit (GPU) based machine. The effects of channel inclination, viscosity and density contrasts are investigated. The contours of the density and the average viscosity profiles in different planes are plotted and compared with two dimensional simulations. We demonstrate that the flow dynamics in three-dimensional channel is quite different as compared to that of two-dimensional channel. In particular, we found that the flow is relatively more coherent in three-dimensional channel than that in two-dimensional channel. A new screw-type instability is seen in the three-dimensional channel which cannot be observed in two-dimensional simulations.

Prasanna R. Redapangu
Indian Institute of Technology Hyderabad

Date submitted: 23 Jul 2013

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