Simulation of Free Surface Flow with the Lattice Boltzmann Method

The lattice Boltzmann method emerged from statistical physics and was proven to be a valuable tool for the simulation of the dynamics of fluids. Although the derivation of the method is mathematically involved, its implementation can be less demanding and simulations more efficient than the implementation of classical Navier-Stokes solvers [1].

The idea of this software lab is to incorporate a free surface model within the lattice Boltzmann method [2]. We will guide you along the way as you develop your own lattice Boltzmann free surface simulation code in C++.

Within this software lab you will:

1. Study the lattice Boltzmann method by reviewing literature and 2D Matlab tutorial code
2. Add a 2D free surface model to the Matlab tutorial code
3. Implement a 3D free surface model on top of an open source lattice Boltzmann programming framework [3].

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References

[1] http://www.lbmethod.org
[2] Körner et al.: "Lattice Boltzmann Model for Free Surface Flow for Modeling Foaming", Journal of Statistical Physics, Vol. 121, Nos. 1/2, October 2005
[3] http://www.palabos.org