

# Experimental Validation of the Lattice Boltzmann Method on a Free Surface Flow Test Problem

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## Abstract

This paper is devoted to the numerical simulation of free surface flow using the lattice Boltzmann method and its validation against experimental data. The main advantage of the lattice Boltzmann method compare to classical methods is that the solution of the Poisson equation, required to meet the condition in the form of the continuity equation, is avoided [1]. The lattice Boltzmann method is therefore simpler and less computationally demanding than the finite element or finite volume methods. To capture the free surface of an incompressible fluid, namely Glycerol, we adopt an algorithm based on the volume of fluid (VOF) method established by Thürey [2]. The advantage of this algorithm is that the mass flow between two grid points is calculated directly using the distribution functions, thereby avoiding the need of introducing a new equation for the motion of the liquid-gas interface as in the case of the classical VOF. The validation of the developed algorithm is preformed on a test problem of gravity casting process which, in the experimental measurement, is captured by a high speed camera. The results show a very good agreement of the numerical algorithm and the experimental data.

## References

1. S. SUCCI AND R. BENZI AND F. HIGUERA. The lattice-Boltzmann equation - a new tool for computational fluid dynamics. *Physica D* 47:219–30.
2. N. THÜREY. Physically based Animation of Free Surface Flows with the Lattice Boltzmann Method. Doctoral thesis, Erlangen (2007).