Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

A new multi-block-LBM scheme for turbulent flow simulations YUSUKE KUWATA, KAZUHIKO SUGA, Osaka Prefecture University — A new lattice Boltzmann multi-block scheme based on the D3Q27 multiple relaxation time method is developed for turbulent flow simulations. In the streaming step, the distribution functions in the interface of each block are transferred by considering the continuity of the macroscopic variables. The mass and momentum continuity is achieved by keeping the consistency between the equilibrium distribution functions of the finer and coarse grids, whilst the non-equilibrium part is scaled for the continuity of the stress tensor. The 3rd order Lagrangian and Helmite interpolations are applied to temporally and spatially discretized variables in the interface region of the blocks. In order to relax the numerical errors occurring at the interface, which may affect the mass and momentum conservation, new distribution functions which are defined by the combination of the two distribution functions from the finer and coarse grids are streamed. The turbulent quantities such as the Reynolds stresses, budget terms of the Reynolds stress equation and power spectrum distributions are compared with those of DNS data by the pseudo spectrum method with good agreement. Moreover, the results show seamless profiles even at the interface of the blocks.

Yusuke Kuwata
Osaka Prefecture University

Date submitted: 28 Jul 2014 Electronic form version 1.4