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INVESTIGATION OF THE MRT-LBM WITH AND WITHOUT FREE SURFACE FLOWS: VALIDATION IN CLASSICAL BENCHMARK PROBLEMS

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The lattice Boltzmann method (LBM) is an efficient numerical fluid dynamics, which does not have to solve the pressure Poisson equation. In recent years, the advanced multiple-relaxation-time collison model (MRT-LBM) has attracted attentions to overcome defeats of the primitive model known as BGK-LBM. The MRT-LBM, however, has difficulties in parameterizations of relaxation rates, especially in which do not relate with the kinematic viscosity coefficient.

In current study, we simulated some classical benchmark problems to verify and validate the MRT-LBM. Firstly, we made a comparison between the BGK-LBM and MRT-LBM to clarify the accuracy in two-dimensional lid-driven cavity flows [1] as an verification. We found that the MRT-LBM has superior accuracy over the BGK-LBM from this test.

Secondly, we simulated standing waves in a rectangular tank [2] with free surface model based on the Volume-of-Fluid (VOF) approach to verify a reproducibility of the non-linear wave phenomenon. Finally, we carried out the validation of the MRT-LBM by classical dam-breaking flows [3] in realistic spacing scale. From the conventional benchmark problems, we found that the MRT-LBM calculates the realistic waves such as breaking-waves well and is robustness in such complex flow fields. We can conclude that the MRT-LBM is useful tools as a way to simulate fluid dynamics.

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