Research of Lattice Boltzmann Method

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● Abstract

The purpose of this research is to construct a collision model considering the influence of bulk viscosity and verify the stability in high Reynolds number flow analysis. In order to compare the computational stability and calculation time using SRT (Single-Relaxation Time) w/o bulk viscosity, the calculation of 2-dimensional shear layer flow was carried out for the verification. It is found that SRT with bulk viscosity improves the stability and accuracy even at low grid-resolution.

● Reasons for using of JSS2

The computational cost of unsteady flow simulation by LBM is very high.

We use JSS2 to reduce the computational cost by paralleization.

● Achievements of the Year

By adding the influence of bulk viscosity to SRT,　the computation stability and accuracy was improved even in the case of high Reynolds number flow and low grid-resolution.
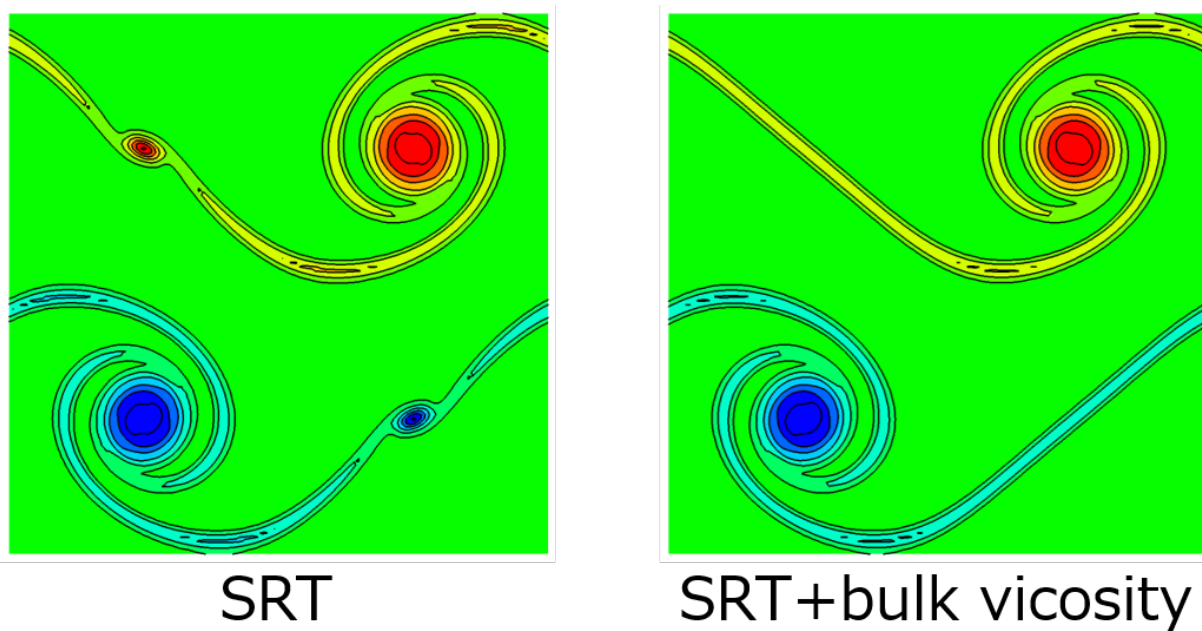
Fig.1 2-dimensional shear layer flow (Reynolds number 10,000)

● Publications

　　● Presentations

1) Toru Yamaya, "Performance evaluation of collision model on Lattice Boltzmann Method", Computational Fluid Dynamics symposium 2016, B06-1.

2) Toru Yamaya, "Numerical simulation of unsteady flows with LBM and statistics comparison of flow fields", Computational Fluid Dynamics symposium 2017, D08-1.

🔵 Usage of JSS2

● Computational Information

Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	2
Elapsed Time per Case	90.00 seconds

● Resources Used

Fraction of Usage in Total Resources*1 (%): 0.34

Details

Computing Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	2,528,479.04	0.34
SORA-PP	0.00	0.00
SORA-LM	0.00	0.00
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage assigned(GiB)	Fraction of Usage*2 (%)
/home	486.37	0.34
/data	48,923.51	0.90
/ltmp	3,906.25	0.29

Archiver Resources		
Archiver System Name	Storage used(TiB)	Fraction of Usage*2 (%)
J-SPACE	0.00	0.00

*1 Fraction of Usage in Total Resources: Weighted average of three resource types (computing, file system, and archiver)

*2 Fraction of Usage: Percentage of usage relative to each resource used in one year