Large-Eddy Simulation of Fluid-Structure Interaction using Lattice Boltzmann Method on Multi-GPU clusters

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A fluid-structure interaction in turbulent states is one of the most challenging themes in CFD (Computational Fluid Dynamics). In order to understand the detail of the object behavior and flow structure, it is necessary to carry out large-scale simulations with high resolutions. We have developed a CFD code based on Lattice Boltzmann method (LBM) using a novel subgrid-scale model named Coherent-structure Smagorinsky model (CSM). The CUDA-based code is able to run on a GPU platform, and it is found that the GPU kernel function achieves high performance on the TSUBAME supercomputer at the Tokyo Institute of Technology. We introduce an accurate moving boundary method into our LBM code. In the presentation, a large-eddy simulation of fluid-structure interaction, such as a movement in the ping-pong ball, is presented and good performance scalability is also shown for multi-GPU computing.

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