Development of a High-resolution Non-thermal Fluid Simulation Code for Minimizing the Dependence on Physical Modeling

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Abstract

The aim of the project is to develop a new simulation code of non-thermal fluid having high-resolution as a reliable optimum-design tool used for various industrial fields. We demonstrated an ultra-high-resolution simulation over 100 billion lattice sites by using a multi-speeded lattice-gas-automaton method with "a Face-Centered Hyper-Cubic 54-velocities model". The model enabled us to execute such a large-scale simulation by using relatively small main storage (about 8TB) in the 64-nodes of ES2. A potential merit of the model is the capability of minimizing the artificial assumptions included in its physical modeling, compared with the conventional CFD-method, and to improve simulation-precision in the process of manufacturing-evaluations for designing aircrafts, automobiles, ships and so on. Thus, the simulation code developed here will make a contribution for reducing environmental load such as carbon dioxide emissions.

Keywords: large-scale simulation, multi-speeded lattice-gas-automaton method, non-thermal fluid simulation, simulation with ultra-high-resolution