Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

A GPU-accelerated semi-implicit fractional step method for numerical solutions of incompressible Navier-Stokes equations[1] SANGHYUN HA, JUNSHIN PARK, DONGHYUN YOU, Pohang University of Science and Technology — Utility of the computational power of modern Graphics Processing Units (GPUs) is elaborated for solutions of incompressible Navier-Stokes equations which are integrated using a semi-implicit fractional-step method. Due to its serial and bandwidth-bound nature, the present choice of numerical methods is considered to be a good candidate for evaluating the potential of GPUs for solving Navier-Stokes equations using non-explicit time integration. An efficient algorithm is presented for GPU acceleration of the Alternating Direction Implicit (ADI) and the Fourier-transform-based direct solution method used in the semi-implicit fractional-step method. OpenMP is employed for concurrent collection of turbulence statistics on a CPU while Navier-Stokes equations are computed on a GPU. Extension to multiple NVIDIA GPUs is implemented using NVLink supported by the Pascal architecture. Performance of the present method is experimented on multiple Tesla P100 GPUs compared with a single-core Xeon E5-2650 v4 CPU in simulations of boundary-layer flow over a flat plate.

[1]Supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (Ministry of Science, ICT and Future Planning NRF-2016R1E1A2A01939553, NRF-2014R1A2A1A11049599, and Ministry of Trade, Industry and Energy 201611101000230)

Sanghyun Ha
Pohang University of Science and Technology

Date submitted: 31 Jul 2017 Electronic form version 1.4