学際大規模情報基盤共同利用・共同研究拠点公募型共同研究 令和2年度採択課題

12th Symposium

jh200051-NAHI

Joint Usage / Research Center for Interdisciplinary Large-scale Information Infrastructures

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Scalable Multigrid Poisson solver for AMR-based CFD applications in Nuclear Engineering

Overview of the entire Research Plan

This project aims at developing exascale computing technologies for multi-scale CFD simulations on exascale platforms. For this purpose, we promote a collaborative research with respect to the following three main subjects, a)High performance sparse matrix solvers on accelerated computing platforms, b) Adaptive Mesh Refinement (AMR) methods for multi-scale turbulence problems with complicated boundaries, c)Performance portability of CFD codes based on advanced frameworks and programming models. The target CFD applications in this project are the 3D multi-phase multi-component thermal hydraulic CFD code JUPITER [Yamashita et al., Nuclear Engineering and Design 2017] and the 3D compressible hydrodynamic astrophysics CFD code ARK [Padioleau et al., Astrophysical Journal 2019]. In this project, we accelerate the development of common exascale computing technologies for AMR-CFD simulations by sharing the knowledges on high performance matrix solvers, performance portability, and AMR methods.



• JUPITER code @ JAEA

Scalable Poisson solver for CFD applications

ARK code @ CEA France

 10^{2}

 10°

Performance portability for exascale applications

Scalable Multigrid Poisson solver on AMR framework

Multigrid Poisson solver on AMR framework





14: $r_{i+1} := r_i - \alpha A p_{i+1}$

16: **end for**

15: Check convergence $|r_{i+1}|$

Three-stage V-cycle MG method on block-AMR data

and MG-CG in a mixed precision (pcg_mg_sp) on block-AMR framework, respectively.

Collaborations : JAEA - CEA France - JHPCN Institution

(1) JHPCN Institutions

Tokyo Tech (TSUBAME3.0, NVIDIA GPU) Tokyo Univ (Oakbridge-CX, Intel Xeon) Nagoya Univ (Flow, Fujitsu FX1000)



✓ Multi-platform performance portability

(2) Research Groups

Representative Deputy Representative

Collaborating Researcher Y. Idor

JHPCN

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Code development Nuclear applications Advice and support on TSUBAME3.0 Large-scale computations Portable programing models Advice and support on Flow Portable programing models Code development Nuclear applications

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