

INNOVATIVE SUPERCOMPUTING, by Integrations of Simulations/Data/Learning , ON LARGE-SCALE HETEROGENEOUS SYSTEMS

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Lecturer: KENGO NAKAJIMA, Professor in the Supercomputing Research Division of the Information Technology Center at the University of Tokyo since 2008. Prior to joining the University of Tokyo in 2004, he spent 19 years in industry.

Also a deputy director of RIKEN R-CCS (Center for Computational Science) since 2018.

His research interest covers computational mechanics, computational fluid dynamics (CFD), numerical linear algebra, parallel iterative algorithms, parallel preconditioning methods, multigrid methods, parallel programming models, adaptive mesh refinement (AMR), and parallel visualization.

He holds a B.Eng (1985, Aeronautics, University of Tokyo), an MS (1993, Aerospace Engineering, University of Texas at Austin), and a PhD (2003, Engineering Mechanics, University of Tokyo).

Abstract: Recently, supercomputing has been changing dramatically. Integration/convergence of Simulation/Data/Learning (S+D+L) is important towards Society 5.0 proposed by Japanese Government, which enables integration of cyber space and physical space. In 2015, we started the BDEC project (Big Data & Extreme Computing) for development of supercomputers and software for integration of (S+D+L). In May 2021, we started operation of the Wisteria/BDEC-01. It is the first BDEC system, which consists of computing nodes for computational science and engineering with A64FX (Odyssey), and those for Data Analytics/AI with NVIDIA A100 GPU's (Aquarius). We also develop a software platform "h3-Open-BDEC" for integration of (S+D+L) on the Wisteria/BDEC-01, which is designed for extracting the maximum performance of the supercomputers with minimum energy consumption focusing on (1) Innovative method for numerical analysis by adaptive precision, accuracy verification and automatic tuning, (2) Hierarchical Data Driven Approach based on machine learning, and (3) Software for heterogeneous systems. Integration of (S+D+L) by h3-Open-BDEC enables significant reduction of computations and power consumption, compared to those by conventional simulations. In January 2025, we started to operate the Miyabi system together with University of Tsukuba. Miyabi consists of GPU Cluster with 1,120 nodes of NVIDIA GH200 (Miyabi-G) and 380 sockets of Intel Max 9480 with HBM2e. In this talk, I will mainly introduce the results related to the integration of (S+D+L) using h3-Open-BDEC on Wisteria/BDEC-01, but will also provide an overview of new innovations using Miyabi.

N.B. A dedicated Hands-on Lab is organised on this advanced HPC topic in collaboration with the U. of Tokyo IT Center.

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Session Classification: POST MOORE, POST EXASCALE HIGH PERFORMANCE COMPUTING ERA