HPCI, Your Gateway to High Performance Computing

The World's Top-class High Performance Computing Infrastructure

Research Organization for Information Science and Technology

Contents

- What is HPCI?
- HPCI Open Call
- User Support
- Publication and Dissemination

What is HPCI?

What is HPCI?

- HPCI, *High Performance Computing Infrastructure*, allocates computing resources of Tier 0 and Tier 1 systems from universities and national laboratories in Japan at open calls.

FY2022 Computational Resources in Total *

240.2 PFlops × Year

FY2022 Shared Storage Capacity in Total

45 PB

* Allocatable resource of Fugaku and allocated resource of other HPCI system based on theoretical peak performance.

Supercomputer Fugaku

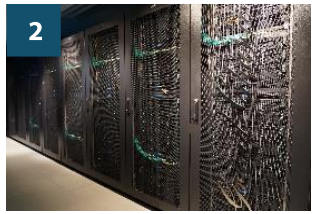
** Resources allocated to HPCI open calls by RIST

Computing Resources of HPCI (FY2022)

RIKEN R-CCS
Supercomputer Fugaku

SINET6
- : SINET Router
- : domestic line (100 Gbps)
- : domestic line (400 Gbps)
- : international line (100 Gbps)

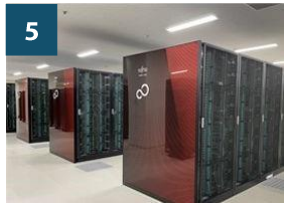
Hokkaido Univ.
Grand Chariot



Tohoku Univ.
AOBA-A

Univ. of Tsukuba
Cygnus

The Univ. of Tokyo/ JCAHPC
Wisteria/BDEC-01(Odyssey)



The Univ. of Tokyo
Oakbridge-CX

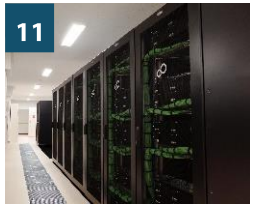
Tokyo Inst. of Tech.
TSUBAME3.0

Nagoya Univ.
"Flow" Type I

Kyoto Univ.
Cray XC40 (~July,2022)

Osaka Univ.
SQUID

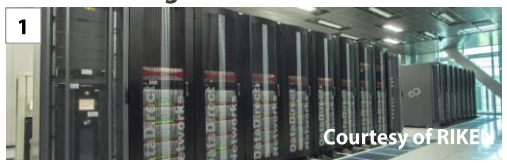
Kyushu Univ.
ITO



JAMSTEC
EARTH SIMULATOR

AIST
ABCI

Shared Storage West Hub (RIKEN R-CCS)



Shared Storage East Hub (The Univ. of Tokyo)

Computing Resources of HPCI (FY2022)

RIKEN Center for Computational Science(R-CCS)

Supercomputer Fugaku (A64FX)

Hokkaido Univ.

Grand Chariot (Xeon Gold 6148)
Polaire (Xeon Phi 7250)

Tohoku Univ.

AOBA-A (SX-Aurora TSUBASA)
AOBA-B (AMD EPYC 7702)

Univ. of Tsukuba

Cygnus (Xeon Gold 6126 + Tesla V100)

The Univ. of Tokyo / Joint Center for Advanced High Performance Computing (JCAHPC)

Wisteria/BDEC-01 (Odyssey) (A64FX)

The Univ. of Tokyo

Oakbridge-CX (Xeon Platinum 8280)
Wisteria/BDEC-01 (Aquarius) (Xeon Platinum 8360Y + NVIDIA A100)

Tokyo Inst. of Tech.

TSUBAME3.0 (Xeon E5-2680v4 + Tesla P100)

CPU A64FX* SX-Aurora TSUBASA x86(intel) x86(AMD)

* Armv8.2-A SVE 512 bit

HPCI

Computing Resources of HPCI (FY2022)

Nagoya Univ.

Supercomputer “Flow” Type I FX1000 (A64FX)

Supercomputer “Flow” Type II CX2570 (Xeon Gold 6230 + Tesla V100)

Kyoto Univ.

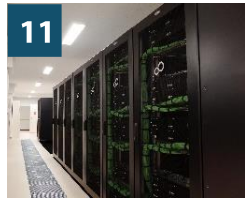
Cray XC40 (Xeon Phi 7250)

* The operation ended in July 2022.

Osaka Univ.

OCTOPUS (Xeon Gold 6126,Xeon Gold6126+Tesla P100, Xeon Phi7210,Xeon Platinum 8153)

SQUID (Xeon Platinum 8360, NVIDIA A100, SX-Aurora TSUBASA)



Kyushu Univ.

ITO Subsystem A (Xeon Gold6154)

ITO Subsystem B (Xeon Gold6140+Tesla P100)

Japan Agency for Marine-Earth Sci. and Tech. (JAMSTEC)

Earth Simulator (ES4) (SX-Aurora TSUBASA, AMD EPYC 7742)

National Institute of Advanced Industrial Sci. and Tech. (AIST)

ABCI 2.0 (Xeon Gold 6148 + NVIDIA V100, Xeon Platinum 8360Y + NVIDIA A100)

* Computational resources managed by the rules of the resource provider.

The Univ. of Tokyo (Eastern Hub) & RIKEN R-CCS (Western Hub)

Shared Storage (Total storage capacity: 45.0PB)

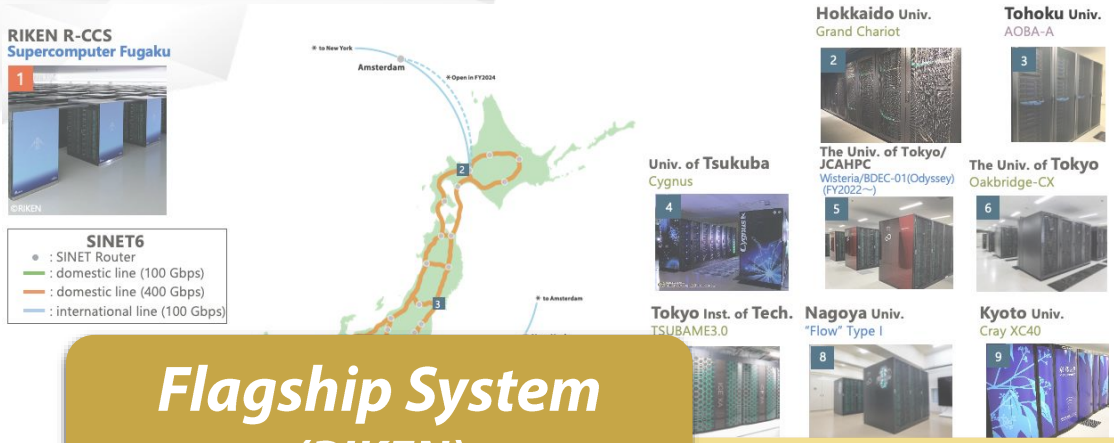
CPU A64FX* SX-Aurora TSUBASA x86(intel) x86(AMD)

* Armv8.2-A SVE 512 bit

HPCI

HPCI Framework

- **Coordinating with RIKEN and Tier 1 entities, RIST promotes HPCI.**



HPCI Users
from Japan &
Worldwide HPC Communities

Project application

- **Selection of proposals and allocation of resources via peer review process**
- **User support and consultation**

Flagship System
(RIKEN)

Tier 1 systems
(Univ. and National Labs.)

Resource provisioning

RIST
Administration office

Government (*MEXT* *1)

***1 : Ministry of Education, Culture, Sports, Science and Technology**

Global Partnership

- **Based on MoUs with PRACE, XSEDE, NSCC Singapore and NCI Australia, RIST is promoting partnership between global HPC communities**

*As XSEDE project terminated, RIST is contacting the follow-on program, ACCESS.

HPCI Open Call

HPCI Open Calls

Periodic Calls

- ✓ Opening Limited Time Period of a Year
- ✓ Allocating Large Amount of Resources

Calls opening throughout the year

- ✓ Relatively Smaller Resources
- ✓ Proposals can be Submitted in a Timely Manner
- ✓ Screening Finishes in a Shorter Period

Project Categories of Fugaku

		Max. Resource Size
Periodic Calls opening twice per year	General Access	Class **L** (**20M NH**) Class **M** (**5M NH**)
	Industrial Access	Class **L** (**8M NH**) Class **M** (**5M NH**)
	General Access for Junior Researchers	Class **M** (**5M NH**)
Calls opening throughout the year	**Small-Scale** (General Access/ Industrial Access/ Junior Researchers)	Class **S** (**1M NH**)
	Trial (General Access/ Industrial Access)	Class **SS** (**100K NH**) First Touch Option (1**K NH**)
	Projects with added services* (usage fee is charged)	Contact RIST if interested

* e.g. Non-disclosure of research achievements.

Project Categories of HPCI Other than Fugaku

Periodic Call opening once per year

- **General Access**
- **Industrial Access**
- **General Access for Junior Researchers**

➡ Size of available resources are different per system.
See HPCI Portal site (Ref. FY2023 Call: https://www.hpci-office.jp/en/using_hpci/proposal_submission_current/e_r05a_boshu)

Calls opening throughout the year

- **Industrial Trial** — Resource size different depending on the system
- Industrial projects with added services (usage fee is charged) — Contact RIST if interested
- **HPCI Infectious Diseases including COVID-19 Research Access** — Special call

Project Categories of HPCI Shared Storage

Calls opening throughout the year	**HPCI Shared Storage (Sharing Use)**	Up to 10 PB (the initial allocation is up to 500 TB)

Timeline of Open Calls

Periodic Calls

Period A (General / Industrial / Junior Researchers)

Call → Screening → Resource Allocation

Call → Screening → Resource Allocation

Period B (General / Industrial / Junior Researchers) * only for Fugaku

Call → Screening → Resource Allocation

Call → Screening → Resource Allocation

HPC Asia 2023

Oct — Apr — Oct — Apr — Oct

Calls opening throughout the year

Small-Scale * only for Fugaku

Screening taking place quarterly

Trial

Screening per submission

Projects with added services (usage fee is charged)

Screening per submission

HPCI

Who Can Apply?

- **Eligibility Requirements***
  - ✓ In principle, researchers in academia or industry, including from outside Japan, are eligible for application.
- **Criteria***

General Access

- ☐ Scientifically excellent / socially valuable research
- ☐ Breakthroughs / pioneering achievements are expected

Junior Researchers

- ☐ Age limit: 39 years old
- ☐ Excellent ideas for which future development are expected

Industrial Access

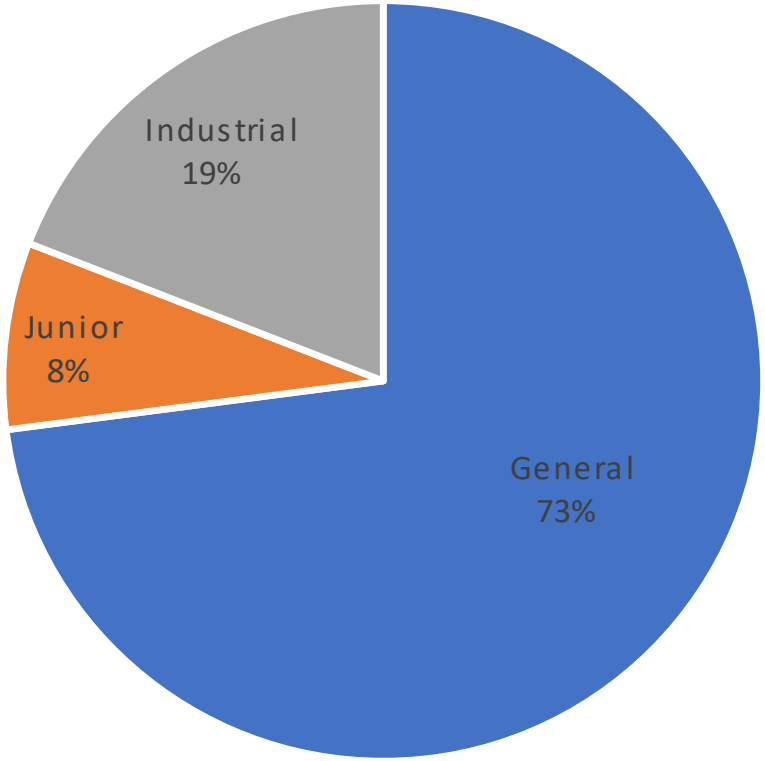
- ☐ Solving important issues in science or socioeconomics.
- ☐ Research impossible to carry out in-house

- **Conditions of Use**
  - ✓ Should be carried out for non-military purposes and in compliance with related laws and social values
  - ✓ Should submit user report after the project finishes.
  - ✓ Should publish research achievements after the project finishes, except for Trial Access projects and Fee-based Access projects.

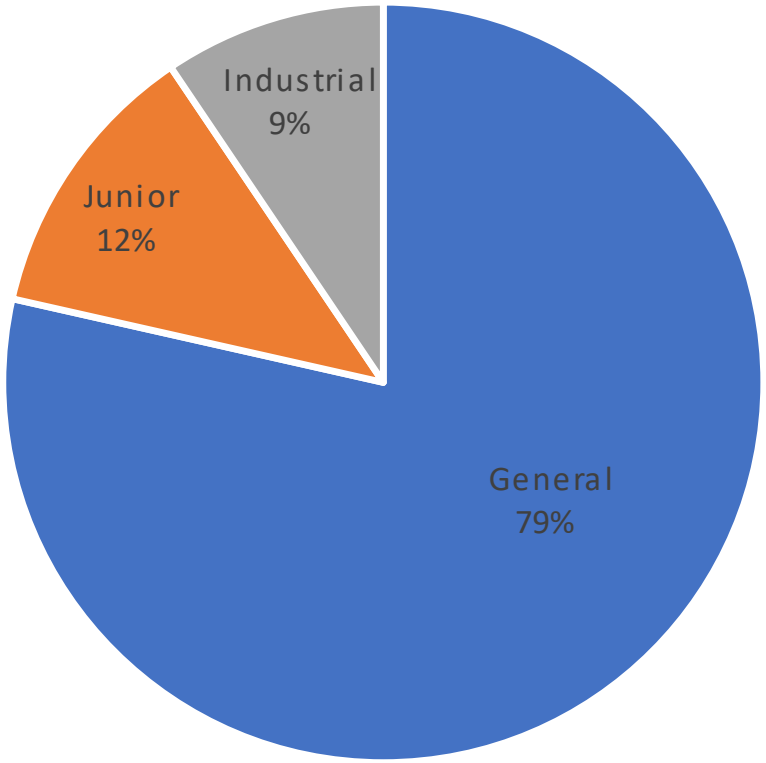
* Note that there are some exceptions to the eligibliity and criteria described above.
For more details, see the proposal preparation instructions for each project category

Statistics - HPCI Resource Allocation (FY2022, periodic call)

Fugaku



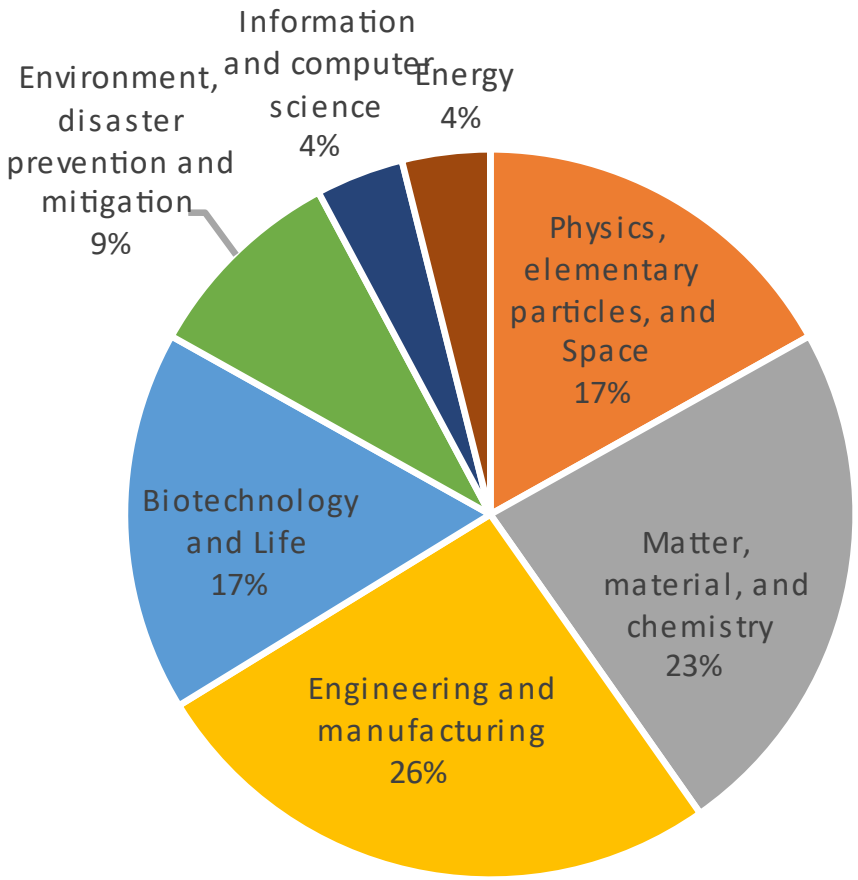
Other HPCI systems



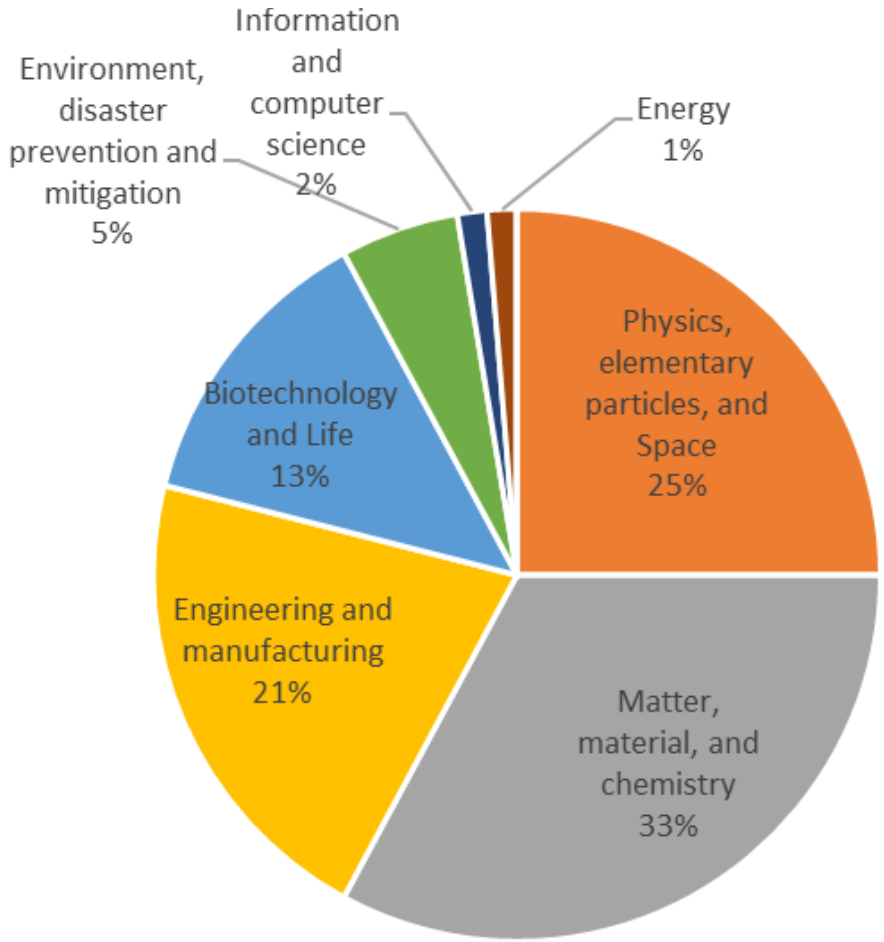
At the start of each project

Statistics - Research Areas of Awarded Projects (FY2022, Periodic call)

Fugaku



Other HPCI systems



Project number based

HPCI

Statistics - Award Rate (FY2022 Periodic Call *1)

		Submitted	Awarded	Award Ratio
Supercomputer Fugaku (tier 0)	General Access	85	42	49.4%
	Junior Researchers	24	12	50.0%
	Industrial Access	25	23	**92.0%**
	Total	134	77	**57.5%**
Other HPCI systems (tier 1)	General Access	48 *2	43+9 *3	89.6%
	Junior Researchers	15 *2	14+2 *3	**93.3%**
	Industrial Access	3 *2	3+1 *3	**100%**
	Total	66 *2	60+12 *3	**90.9%**

1) For Fugaku, both "Period A" and "Period B" of FY 2022 are included.
2) Number of projects submitted for other HPCI systems as a first choice.
3) Number of projects submitted for Fugaku as a first choice and rejected, then selected for other HPCI systems.

A total of 149 projects awarded!

Statistics - Award Rate (FY2021 Calls opening throughout the year)

		Submitted	Awarded	Award Ratio
Supercomputer Fugaku (tier 0)	Trial for General Access	62	62	100%
	Trial for Industrial Access	24	24	100%
	Small scale for General Access	12	11	91.7%
	Small scale for Junior Researchers	5	4	80%
	Small scale for Industrial Access	1	1	100%
	Total	104	102	98.1%
Other HPCI systems (tier 1)	Trial for Industrial Access	3	3	100%
	Proprietary Use	0	0	-
	HPCI Infectious Diseases including COVID-19 Research Access Projects	4	4	100%
	Total	7	7	100%

Fugaku International Collaboration Projects

- **In accordance with agreement between RIST and The National Supercomputing Centre (NSCC) Singapore, an annual call for Fugaku projects via NSCC has been open to Singapore researchers since FY2022.**
  - ✓ **Overview of the call**
    - **Available Resources: up to 1 MNH in total**
    - **Number of Projects: up to ~5**
    - **Project Period: up to one year**
  - ✓ **For FY 2023**
    - **The call opened from Nov. 1st, 2022 to Nov. 30th, 2022.**
    - **5 proposals were awarded from 15 submissions.**
    - **The total resources are 1 MNH.**
    - **The project period is from April 1st, 2023 to March 31st, 2023.**

For more details, see the NSCC website!

User Support

User Support

- **RIST provides a variety of services with the Helpdesk as the general contact point for users.**

HPCI Portal Site
(Sharing Info. & Publication of Achievements)
- Call for Proposals
- User Reports Database
- HPCI Publication Database

Seminars & Workshops

Inquiry / request

Feedback

Helpdesk

First Level Support
- Assist with project application procedures
- Provide hardware and software information
- Help building and running jobs
- Advise on libraries and tools

Advanced Support
- User application porting
- Serial and scalability optimization
- Community Application Software provisioning

Advanced User Support

- ~30 projects receive advanced support every year, handled by 20 experts
  - A wide range of research areas is covered
  - Support focuses on performance analysis and optimization
- Implementation and Optimization
  - ~30 application programs every year
    - OpenFOAM (RapidCFD): 2.0x faster, multiple GPU
    - LAMMPS: 2.0x faster
    - Earthquake Simulator (NP*): 3.2x faster
    - QUANTUM ESPRESSO, GROMACS, FrontISTR(NP*), VASP, … and much more
- Community application software provisioning
  - Pre-install commonly used application software to HPCI system
    - OSS: OpenFOAM, LAMMPS, QUANTUM ESPRESSO, GROMACS
    - NP*: NTChem, MODYLAS, SMASH, OpenMX, SALMON, HΦ, GENESIS, ABINIT-MP, PHASE/0, FrontFlow/blue, FrontISTR

    * NP : applications developed in Japanese national projects

Seminars & Workshops

- **Introductory course for HPCI system and advanced programing & tuning course**
- **Application specific seminars**
  - **QUANTUM ESPRESSO, LAMMPS, OpenFOAM**
  - **OSS: OpenFOAM, LAMMPS, QUANTUM ESPRESSO**
  - **NP＊: OpenMX, SALMON, HΦ, ABINIT-MP, PHASE/0, FrontISTR**

＊NP : applications developed in Japanese national projects

- **Workshops**
  - **Materials science, CAE, Code tuning …**

Materials science workshops
Many advanced users keep informed on the latest issues

18 events
Over 1,200 participants

the last fiscal year

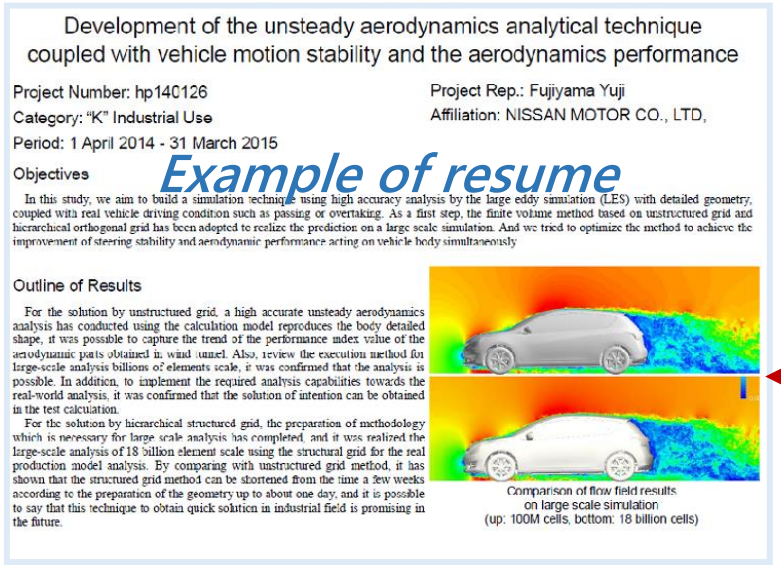
Publication and Dissemination of HPCI Research Achievements

HPCI User Reports

- **~ 2,191 User Reports published in the HPCI Portal Site since the start of HPCI shared use in Sep. 2012**
- **~214,311 downloads of User Reports (15/7/2014～31/12/2022) excluding insubstantial downloads such as crawlers etc.**

Search screen for the User Reports
~ List of research areas ~

A User Report consists of outcome (several pages) and resume (one page).



Development of the unsteady aerodynamics analytical technique coupled with vehicle motion stability and the aerodynamics performance

Project Number: hp140126
Category: "K" Industrial Use
Period: 1 April 2014 - 31 March 2015

Project Rep.: Fujiyama Yuji
Affiliation: NISSAN MOTOR CO., LTD.

Example of resume

Objectives

In this study, we aim to build a simulation technique using high accuracy analysis by the large eddy simulation (LES) with detailed geometry, coupled with real vehicle driving condition such as passing or overtaking. As a first step, the finite volume method based on unstructured grid and hierarchical orthogonal grid has been adopted to realize the prediction on a large scale simulation. And we tried to optimize the method to achieve the improvement of steering stability and aerodynamic performance acting on vehicle body simultaneously.

Outline of Results

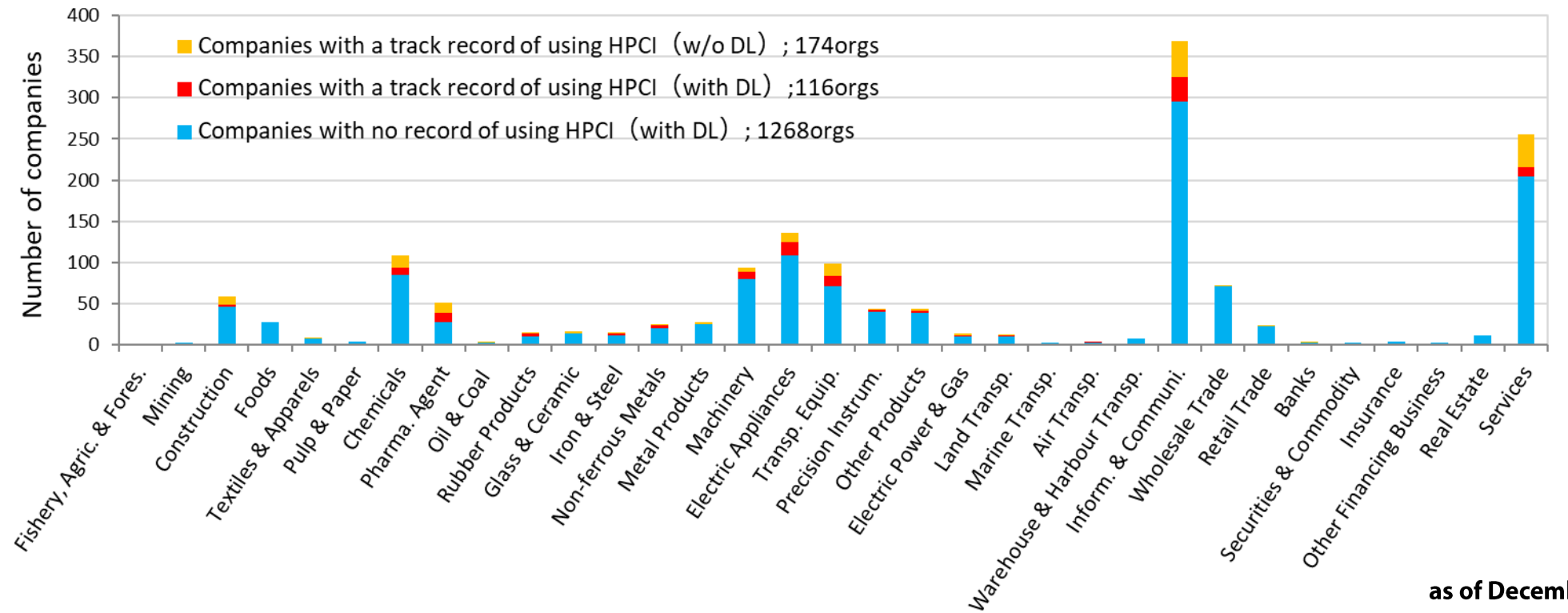
For the solution by unstructured grid, a high accurate unsteady aerodynamics analysis has conducted using the calculation model reproduces the body detailed shape, it was possible to capture the trend of the performance index value of the aerodynamic parts obtained in wind tunnel. Also, review the execution method for large-scale analysis billions of elements scale, it was confirmed that the analysis is possible. In addition, to implement the required analysis capabilities towards the real-world analysis, it was confirmed that the solution of intention can be obtained in the test calculation.

For the solution by hierarchical structured grid, the preparation of methodology which is necessary for large scale analysis has completed, and it was realized the large-scale analysis of 18 billion element scale using the structural grid for the real production model analysis. By comparing with unstructured grid method, it has shown that the structured grid method can be shortened from the time a few weeks according to the preparation of the geometry up to about one day, and it is possible to say that this technique to obtain quick solution in industrial field is promising in the future.

Comparison of flow field results on large scale simulation
(up: 100M cells, bottom: 18 billion cells)

Dissemination of Industrial Use Outcomes

- **Industry sectors of companies with track records of using HPCI and/or downloading HPCI User Reports are classified by *33 sectors of the Tokyo Stock Exchange.***



as of December 2022

Number of sectors with track records of using HPCI : *23 (70 % of 33 sectors)*

Those downloading HPCI User Reports: *32 (97 % of 33 sectors)*

➡ Indicates widespread interest of HPCI research outcomes in the industry

HPCI Publication Database

- **Publication information of research achievements with the use of the HPCI system are summarized in an integrated manner.**
- **It is encouraged to register research achievements as soon as they are published during or after implementation of projects.**

Interfaces for a viewer

Results publication number that matches the criteria of the current

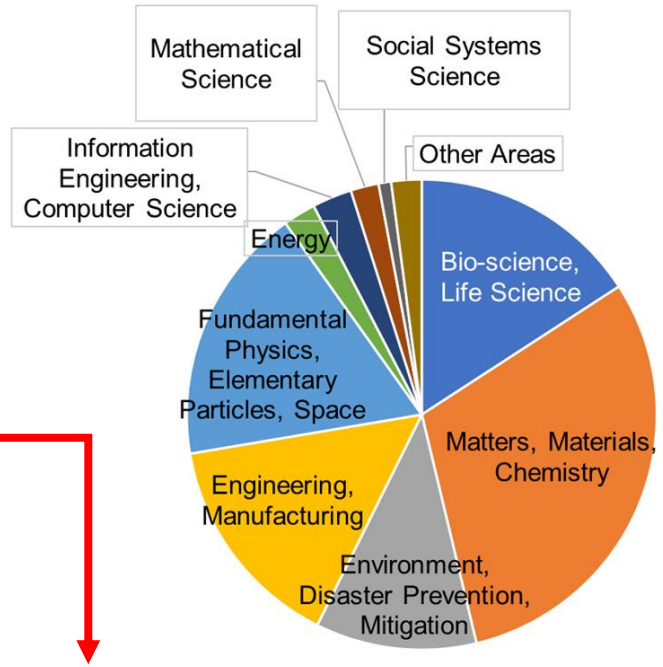
Date Range: Any Publication Date
Resources that were used: The main resource for each category
Language: Any Language
公開日: ～ 2022年12月31日 24:00:00 (JST)

*Please click any active cell for listing items.

Two display modes: research areas / project categories

	Kinds of Projects (Publications due to multiple projects will be counted as the number of each cell.) Display Mode										Total	Net Num. of Publications
	Research Areas of HPCI Projects											
	Bio-science, Life Science	Matters, Materials, Chemistry	Environment, Disaster Prevention, Mitigation	Engineering, Manufacturing	Fundamental Physics, Elementary Particles, Space	Energy	Information Engineering, Computer Science	Mathematical Science	Social Systems Science	Other Areas		
Peer-reviewed Paper	493	947	345	467	554	70	85	60	27	65	3113	2912
Non-peer-reviewed Paper	48	23	45	58	20	6	3	1	33	4	241	233
International Conf., Symp.	378	415	579	362	494	175	21	31	10	35	2500	2423
Domestic Conf., Symp.	702	408	374	465	335	127	17	14	13	55	2510	2419
Research Meeting, etc.	278	149	199	80	160	16	16	12	2	25	937	914
Public Lecture meeting, etc.	227	38	59	42	63	0	2	2	5	6	444	438
Media: Newspaper, TV, etc.	338	68	158	24	74	0	1	1	0	10	674	662
Books	45	16	7	3	1	0	1	0	0	2	75	74
Code, Database published	6	5	1	1	2	0	0	0	0	0	15	15
PAT. applied	5	3	0	1	0	0	0	0	0	0	9	9
PAT. granted	6	11	0	4	0	0	0	0	0	1	22	20
Total	2526	2083	1767	1507	1703	394	146	121	90	203	10540	10119
	10540											

RESEARCH AREAS OF REFEREED PAPERS



2912(2619)
Refereed Papers (in English)

as of December 2022

Statistics on Refereed Papers

- **Percentages of *high citation papers (Top 10 %, Top 1 %)* are 14.1% and 1.8 %, respectively, in total HPCI.**
- **They tend to increase *in international co-authored papers*, i.e., 23.0% and 3.1 %, respectively.**
- **Achievement obtained by using Fugaku is beginning to be published.**

(as of Nov. 2022)

Project Category	Whole Refereed Papers			International Co-authored Papers		
	Nr. of refereed papers	Percentage of Top 10 % papers	Percentage of Top 1 % papers	Nr. of refereed papers	Percentage of Top 10 % papers	Percentage of Top 1 % papers
Fugaku General Use	31	9.7%	0.0%	8	25.0%	0.0%
Promoting Researches on Fugaku	72	12.5%	2.8%	19	36.8%	10.5%
K General Use	480	15.2%	1.5%	131	23.7%	1.5%
HPCI other than Fugaku / K	717	11.2%	2.0%	214	15.9%	2.8%
HPCI Strategic Programs	472	20.8%	2.1%	159	31.4%	3.1%
Post K Computer Priority Issues	595	15.8%	2.5%	188	28.7%	4.3%
Post K Computer Exploratory Challenges	115	8.7%	0.9%	29	17.2%	3.4%
Sum (without duplication)	2,035	14.1%	1.8%	604	23.0%	3.1%

Target data are refereed papers (limited to article and review) which are achievements using HPCI computer resources and registered both in HPCI Publication Database and Web of Science. Some papers are duplicated among project categories. Data on high citation papers are based on InCites Benchmarking (1/11/2022).

HPCI Supercomputers Are Open to the World!

★ Small-Scale and Trial Project Call
Open Throughout the Year!

★ Regular Call Opens twice a year!
September : Period A (Fugaku and other HPCI)
March : Period B (Fugaku only)

We are looking forward to your innovative proposals!

More details HPCI Portal site
https://www.hpci-office.jp/en