Development of Aerodynamic Optimization Library: Harmonee

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● **Abstract**

An aerodynamic optimization library "Harmonee," which uses the unstructured CFD code FaSTAR, is develped and its validity and efficiency are examined. A Multi-Objective Evolutionary Algorithm (MOEA) is employed as an aerodynamic optimization method. This tool is aimed to enable the direct evolutionary computing to perform within a practical computational time by utilizing the high speed performance of FaSTAR. In the present project, basic programs are developed and validated using JSS.

● **Reasons and benefits of using JAXA Supercomputer System**

Aerodynamic optimization using an evolutionary algorithm requires a number of high-fidelity and large-scaled computations (3D RANS analysis) and needs to use the supercomputer.

● **Achievements of the Year**

The surrogate model assisted module of 'Harmonee' and 'WingBoxGen', structure sizing tool developed by JAXA, were applied to the multi-objective optimization problem for the aero-structural design. We improved Harmonee and comfirmed that reasonable pareto optimal solutions were obtained faster than before.

● **Publications**

N/A

● **Usage of JSS**

● **Computational Information**

Process Parallelization Methods	MPI
Thread Parallelization Methods	Automatic Parallelization
Number of Processes	128
Elapsed Time per Case	2 Hour(s)

● **JSS3 Resources Used**

Fraction of Usage in Total Resources[*1](%): 0.08

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	681,389.39	0.03
TOKI-ST	50,416.51	0.06
TOKI-GP	0.00	0.00
TOKI-XM	20,441.11	14.73
TOKI-LM	0.00	0.00
TOKI-TST	0.00	0.00
TOKI-TGP	0.00	0.00
TOKI-TLM	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2](%)
/home	472.12	0.47
/data and /data2	103,284.66	1.10
/ssd	310.10	0.08

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[2](%)
J-SPACE	0.28	0.00

[1]: Fraction of Usage in Total Resources: Weighted average of three resource types (Computing, File System, and Archiver).

[2]: Fraction of Usage：Percentage of usage relative to each resource used in one year.

- **ISV Software Licenses Used**

ISV Software Licenses Resources		
	ISV Software Licenses Used (Hours)	Fraction of Usage[2](%)
ISV Software Licenses (Total)	42.06	0.03

[2]: Fraction of Usage：Percentage of usage relative to each resource used in one year.