- **JSS3 Resources Used**

Fraction of Usage in Total Resources[*1](%): 0.10

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	2,656,834.93	0.12
TOKI-ST	809.32	0.00
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
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	192.67	0.16
/data and /data2	20,900.87	0.13
/ssd	2,130.62	0.20

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2] (%)
J-SPACE	7.46	0.03

[*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)	21.31	0.01

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

Development of Aerodynamic Optimization Library: Harmonny

Report Number: R23EA3202
Subject Category: Aeronautical Technology
URL: https://www.jss.jaxa.jp/en/ar/e2023/23660/

Responsible Representative

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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 JSS3.

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

Originally, a method called Selective Frequency Damping (SFD), which was proposed as a method for obtaining a steady-state solution by attenuating the transient components of the flow field, has been introduced into FaSTAR. The SFD has two parameters, the cutoff frequency and the attenuation intensity, and their appropriate settings are the key. In this fiscal year, the degree of convergence was set as the objective function for a certain flow field, and optimization was performed multiple times using the two parameters of SFD as a design variable. As a result, we succeeded in obtaining a parameter configuration that quickly converges to the target steady-state solution while attenuating the fine fluctuations leading up to convergence (Fig. 1.)

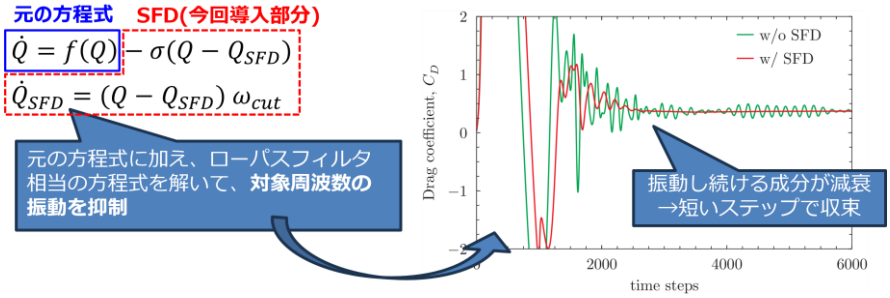

Fig. 1: Overview of Selective Frequency Damping and its application

- **Publications**

  N/A

- **Usage of JSS**

- **Computational Information**

Process Parallelization Methods	MPI
Thread Parallelization Methods	Automatic Parallelization
Number of Processes	512
Elapsed Time per Case	1 Hour(s)

- **JSS3 Resources Used**

Fraction of Usage in Total Resources[*1](%): 0.37

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	9,369,873.09	0.42
TOKI-ST	5,527.45	0.01
TOKI-GP	0.00	0.00
TOKI-XM	13,577.85	7.44
TOKI-LM	100.29	0.01
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	528.00	0.44
/data and /data2	134,541.26	0.83
/ssd	836.67	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)	295.95	0.13

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