Application of the Cartesian grid and an IB method to the analysis of aircraft engine combustors

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Abstract

Enabling to conduct numerical analysis of thermal fluid phenomena within aircraft engine combustors using HINOCA-AE ensuring reasonable TAT (Turn Around Time) and accuracy, the potential for expanding the application of numerical analysis to combustor design is explored.

Reasons and benefits of using JAXA Supercomputer System

Massive-parallel large scale simulation, Large number of simulations for software validation

Achievements of the Year

Combustion analysis using a solver employing orthogonal grids and the Immersed Boundary method was conducted for a realistic scale combustor. Challenges for achieving practical CFD simulations for combustor design with reasonable TAT and accuracy were extracted.



Fig. 1: Time averaged fuel mole fraction



Fig. 2: Time averaged CO2 mole fraction



Fig. 3: Time averaged H2O mole fraction



Fig. 4: Time averaged total temperature(Non-dimensional)

Publications

N/A

Usage of JSS

• Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	1 - 5666
Elapsed Time per Case	350 Hour(s)

• JSS3 Resources Used

Fraction of Usage in Total Resources^{*1}(%): 1.59

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage*2(%)
TOKI-SORA	42,834,648.48	1.93
TOKI-ST	112,256.24	0.12
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	1,972.62	1.64
/data and /data2	154,185.10	0.95
/ssd	37,558.02	3.55

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage ^{*2} (%)
J-SPACE	1.71	0.01

*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)	110.66	0.05

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