The modeling of Crossflow Type Atomization

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Abstract

The purpose of the research is to construct the numerical model of cross flow atomization which can predict the particle size distribution precisely and efficiently. As the previous models recognized all droplets as spheres and caused irregularities, this study aims to consider droplets' shapes. Finally, we are going to improve the calculation efficiency by applying the deep learning technologies to the analysis.

The development of this model contributes to efficient designing of the aerospace engines, as this cross flow atomization is introduced to the main burners of them.

Reasons and benefits of using JAXA Supercomputer System

We used the supercomputer to get datasets for the model construction.

As it is difficult to capture the atomization phenomenon by experimental way in cross flow,

we have to run detailed numerical calculations which require large calculation costs.

At first, we took spatial and chronological sampling of the droplets in the detailed calculation for grasping shape distributions and droplets' motions. Using this information, we are constructing the model based on geometrical and statistical analysis.

Achievements of the Year

By conducting the spatial sampling for the result of detailed numerical analysis, we gathered the data of droplet shapes in cross flow atomization. Fig.1 shows the example of these droplets. In addition to that, the facts that the geometric parameter can evaluate droplet shapes and deep learning technologies can be applied for improve the efficiency of the calculation costs in the model are indicated.

Analyzing these results and combining more detailed analysis or chronological droplet information, the construction of the model considering droplet shapes, which is the goal of the study, is in progress.

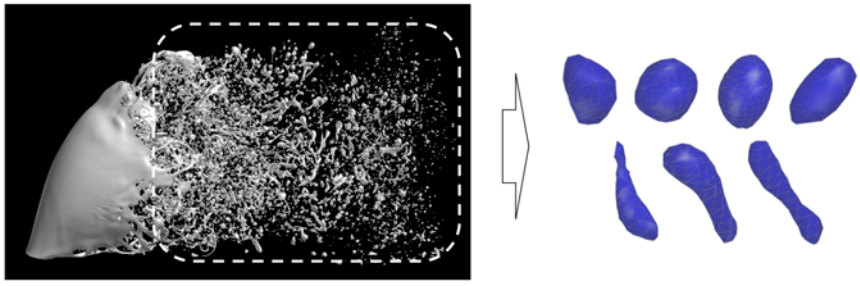

Fig. 1: The example of droplets extracted from detailed numerical calculation of the cross flow

Publications

- Oral Presentations

Sakano, Y., Sato, T., Evaluation of 3D Shape Representation Method of Droplets in Crossflow Type Atomization, The Fifty-Eighth Symposium (Japanese) on Combustion, Online, Dec. 2020.

Sakano, Y., Sato, T., 3D Shape Recognition of Droplets in Atomization Modeling Based on Deep Learning Technique, 29th ILASS-Japan Symposium, Online, Dec. 2020.

Usage of JSS

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	1452
Elapsed Time per Case	24 Hour(s)

- **Resources Used(JSS2)**

Fraction of Usage in Total Resources[*1](%): 0.00

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2](%)
SORA-MA	1,766.73	0.00
SORA-PP	3,241.66	0.03
SORA-LM	0.00	0.00
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2](%)
/home	9.54	0.01
/data	953.67	0.02
/ltmp	1,953.13	0.17

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

- **Resources Used(JSS3)**

Fraction of Usage in Total Resources[*1](%): 0.00

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	0.00	0.00
TOKI-RURI	1,636.18	0.01
TOKI-TRURI	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2](%)
/home	9.54	0.01
/data	953.67	0.02
/ssd	95.37	0.05

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