Numerical calculation of Green engine (study of ultrahigh-temperature low NOx emission combustor technology) filming-type airblast atomizing process

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Abstract

Experimental study of planner filming-type airblast atomizer shows the clear effects of the ambient pressure and the vane angles on atomization characteristics. Since the atomization process occurs in the narrow region which is vicinity of the injection outlet, it is difficult to understand the atomization phenomena only by experiment. The objective of this work is to understand the atomization mechanism by numerical study which calculate the atomization field in the near region of the injection outlet.

Reasons for using of JSS2

The particle diameter is order of 10 micron in the experiment. In order to calculate this size of atomization field precisely, large scale calculation with more than a few of hundred million of cells which size is a few micron meter order is needed and the use of super computer is necessary.

Achievements of the Year

We revised VOF code to reproduce the experimental results of planner filming-type airblast atomizer that the particle diameter with lower ambient pressure becomes larger. We conducted the numerical simulation of milk crown as benchmark test (Fig.1,2). It was confirmed that the revised code reproduce instability needed to form a crown. In the numerical analysis by the revised code for planner filming-type airblast atomizer (Fig.3,4), it was shown that large droplets are divided from ligament, and we came to be able to understand detailed mechanism of break-up which is difficult in the experiment.

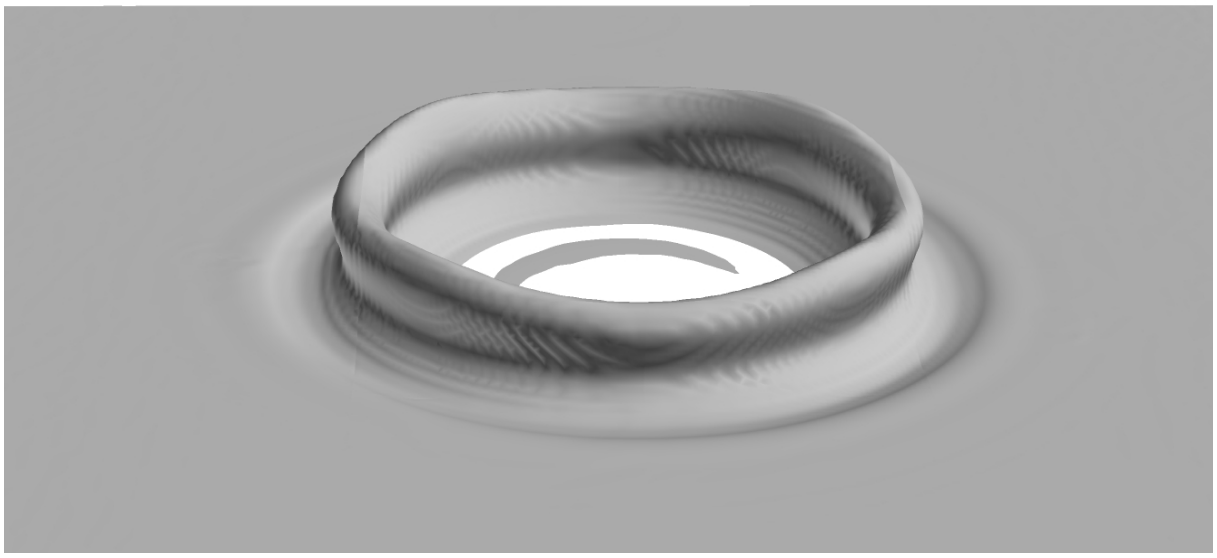

Fig.1 Milk crown (Old code)

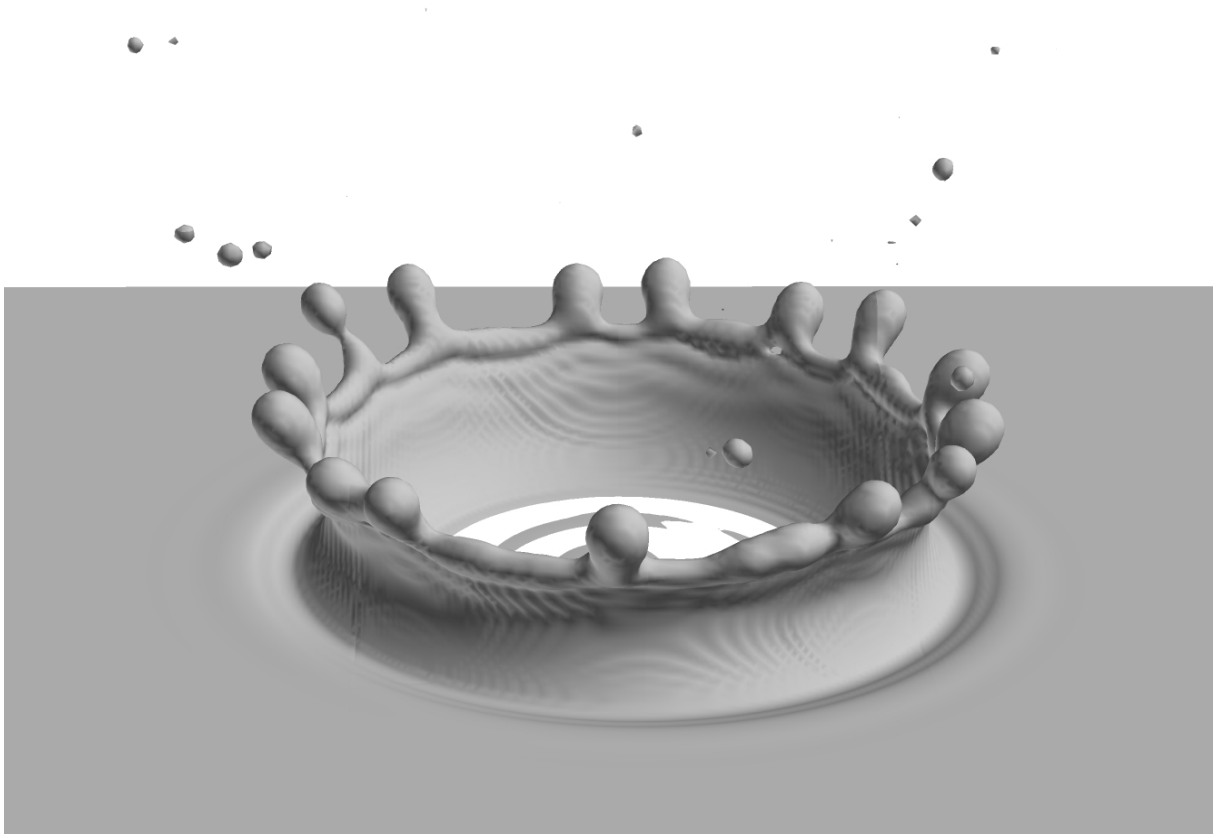

Fig.2 Milk crown (New code)

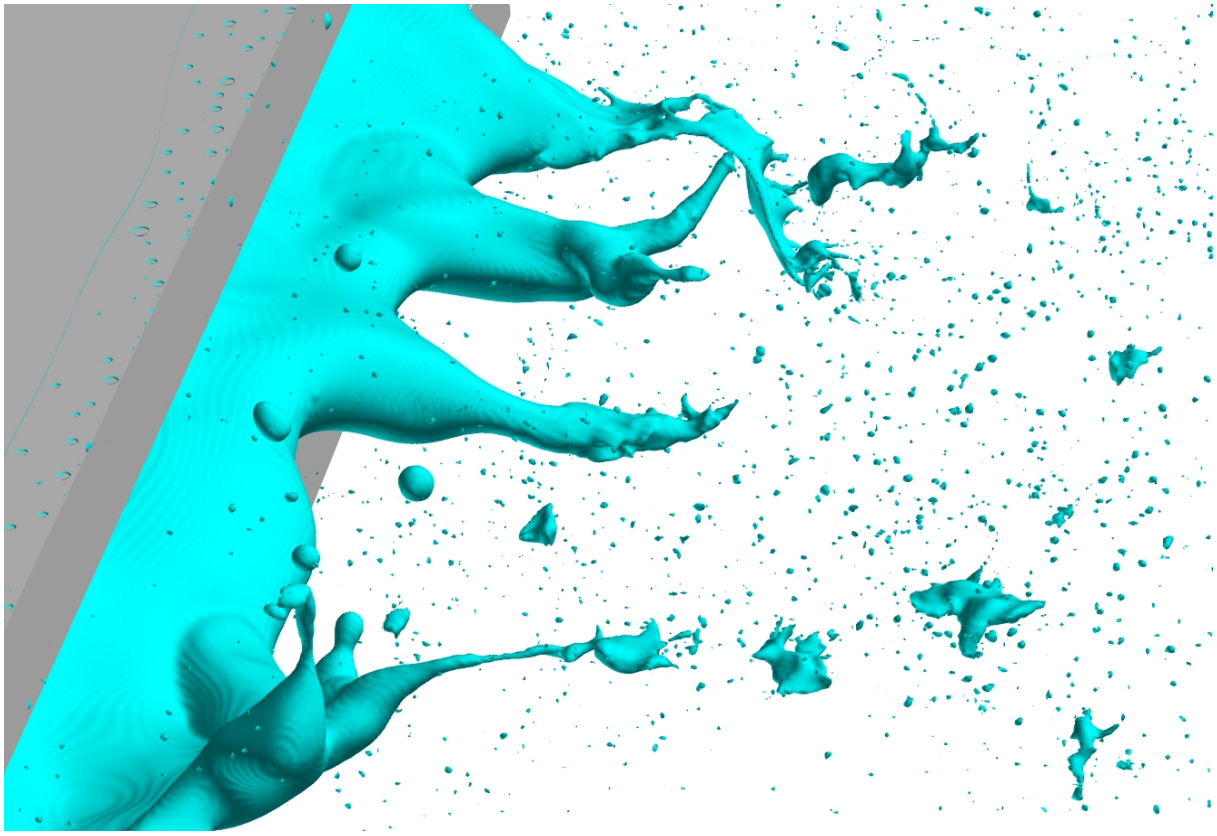

Fig.3 Planner filming-type airblast atomizer (Low ambient pressure)

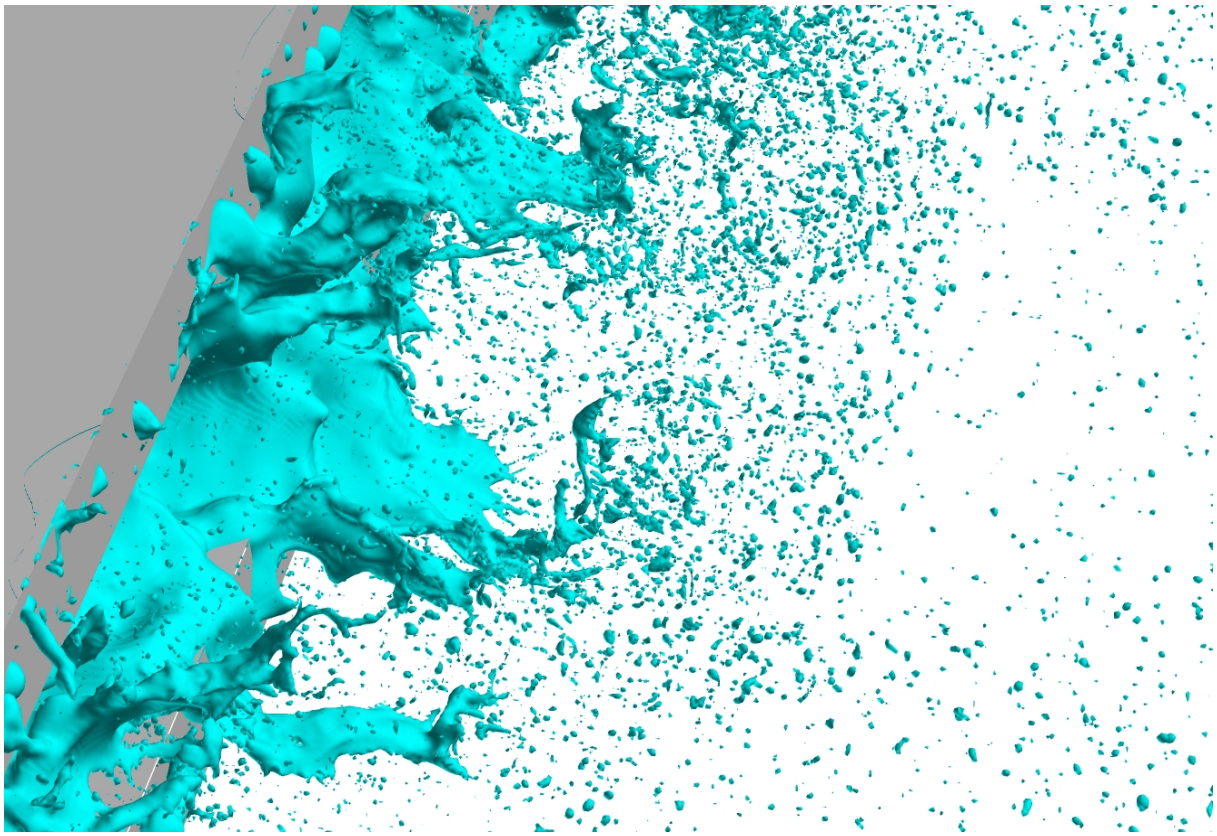

Fig.4 Planner filming-type airblast atomizer (High ambient pressure)

Publications

N/A

Usage of JSS2

Computational Information

Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	96 - 768
Elapsed Time per Case	600.00 hours

Resources Used

Fraction of Usage in Total Resources*1 (%): 0.53

Details

Computing Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	4,123,371.56	0.55
SORA-PP	1,243.18	0.02
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	168.11	0.12
/data	42,757.27	0.79
/ltmp	14,865.46	1.12

Archiver Resources		
Archiver System Name	Storage used(TiB)	Fraction of Usage*2 (%)
J-SPACE	0.14	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