

Research for Innovation of Rocket Propulsion Engine

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● Abstract

Reusable rockets are attracting attention as spacecraft, but their engines are required to have high performance at a wide range of environmental pressures. In this research, the performance of the aerospoke nozzles was investigated by using large-scale numerical fluid dynamics.

● Reasons for using of JSS2

The number of experiments is limited, and the data obtained are limited. Therefore, after verification of numerical results, data which are difficult to obtain by wind tunnel test can be obtained. By using higher-performance computer, more reliable data can be obtained and the development of nozzle technology are accelerated.

● Achievements of the Year

We began to do research on the aerospoke nozzles by using the numerical fluid dynamics. Since it was necessary to verify the numerical results with the experimental data obtained, numerical analysis was conducted the liner aerospoke nozzles of 40% and 60% in addition to the 80% linear aerospoke nozzle. Computations were performed and numerical results were obtained when the nozzle pressure ratio (NPR) were 10, 40, 100. Details of the flow analysis are under consideration.

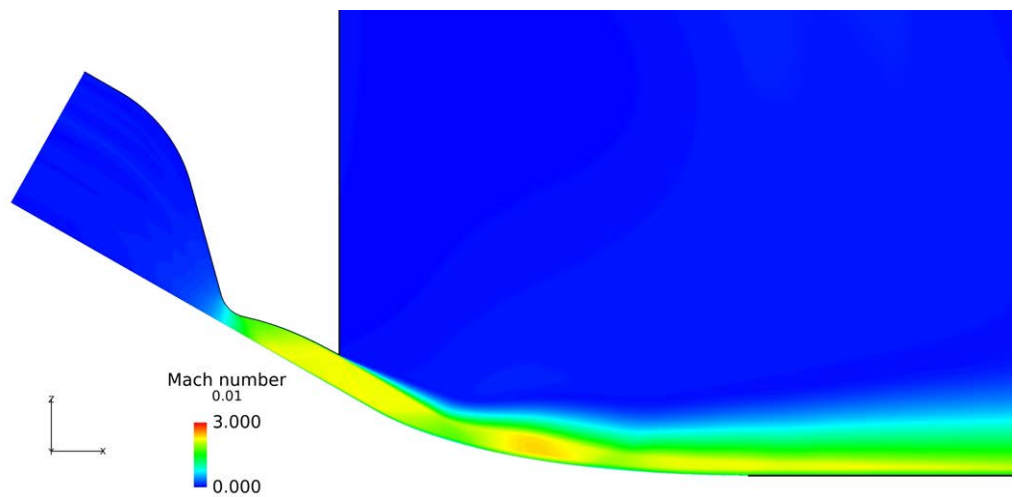


Fig.1 Mach number distribution around the 80% linear aerospike nozzle, NPR=10

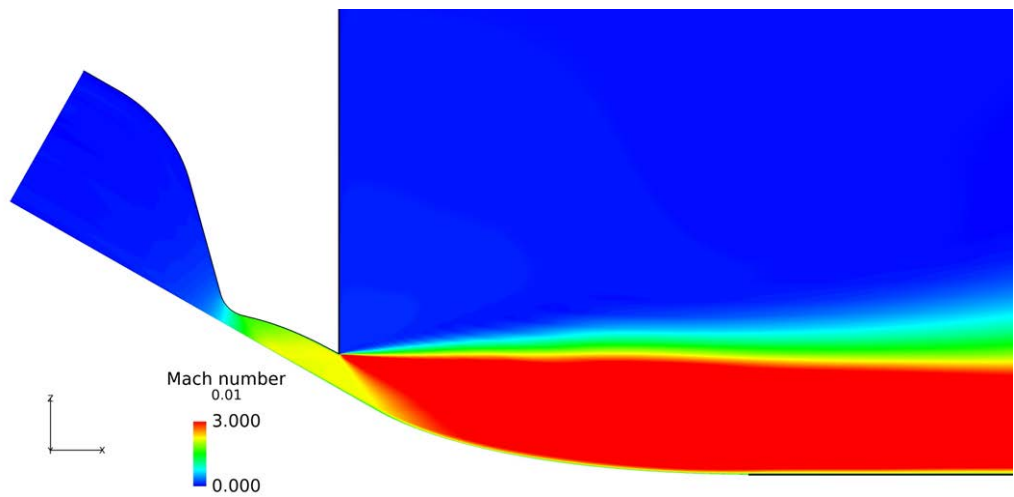


Fig.2 Mach number distribution around the 80% linear aerospike nozzle, NPR=100

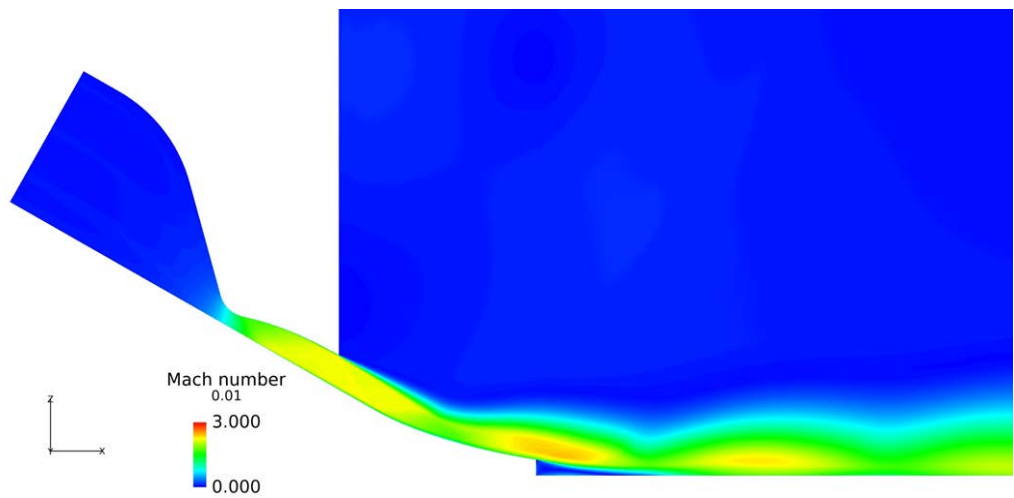


Fig.3 Mach number distribution around the 60% linear aerospike nozzle, NPR=10

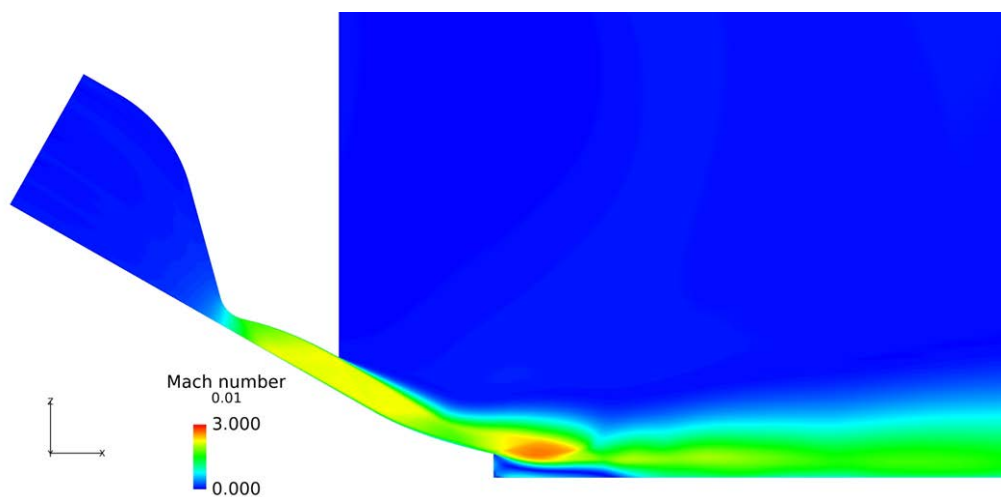


Fig.4 Mach number distribution around the 40% linear aerospike nozzle, NPR=10

● Publications

N/A

● Usage of JSS2

● Computational Information

Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	32 - 256
Elapsed Time per Case	3.00 hours

● Resources Used

Fraction of Usage in Total Resources*1 (%): 0.01

Details

Computing Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	6,423.68	0.00
SORA-PP	9.49	0.00
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	100.89	0.07
/data	5,034.13	0.09
/ltmp	11,067.71	0.83

Archiver Resources		
Archiver System Name	Storage used(TiB)	Fraction of Usage*2 (%)
J-SPACE	1.15	0.05

*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