Numerical study on low-speed buffet

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Abstract

It is of a great importance to predict a so-called low-speed buffet phenomenon for realizing safer flight. During a flight with a high angle-of-attack condition in a low-speed regime, separated flow at a leading edge of main wing impinges on its tail, resulting in a hazardous vibration. Our research group works on a preliminary study on low-speed buffet by means of computational fluid dynamics (CFD) in order to grasp the essence of the phenomenon.

Reasons for using of JSS2

It is absolutely necessary to prepare a computational grid with high-resolution near the separated zone in order to predict a low-speed buffet phenomenon accurately. The number of grid point is of the order of tens of millions, which is prohibitively large from a view point of a computation with a personal computer. The processing capability of JSS2 is therefore necessary for our research.

Achievements of the Year

Two models were considered in this study; NASA Common Research Model (NASA CRM) as model 1 and the same model without main wing as model 2 as shown in (Fig.1). Comparison of flowfield around each model were conducted by carefully calculating the effective angle of attack of the tail by subtracting a downwash from a flow velocity in the flowfield around model 1. (Fig. 2) presents a variation of lift coefficient of the tail against its effective angle of attack, clearly showing an apparent difference in lift coefficient at angle of attack of 8 degrees, at which model 1 began to stall. This indicates a clear correlation between a stall of main wing and a sharp drop of the lift of a tail.

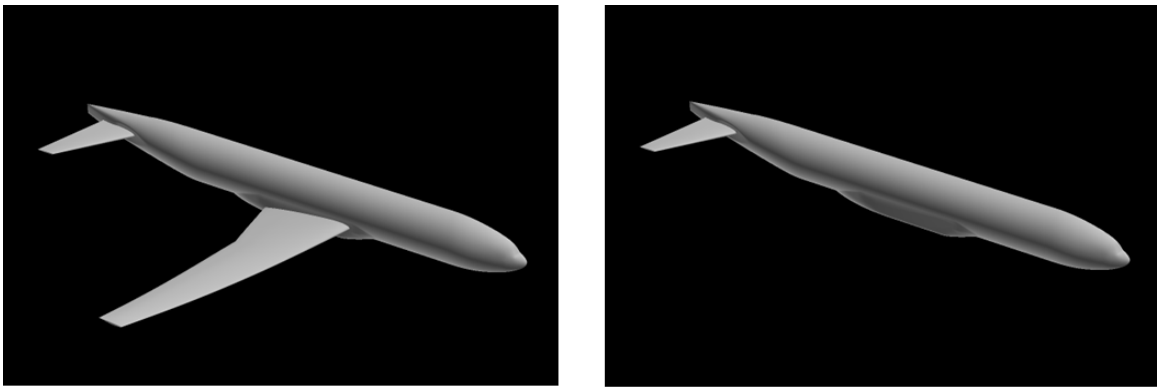

Fig.1 model 1 and model 2

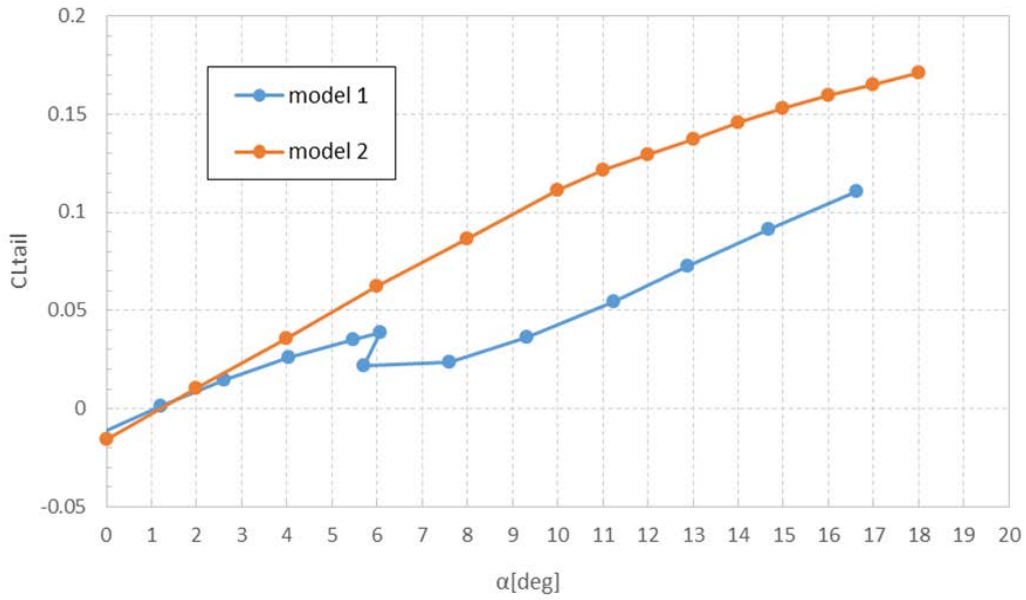

Fig.2 variation of lift coefficient of tail against effective angle of attack

Publications

N/A

Usage of JSS2

Computational Information

Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	512
Elapsed Time per Case	12.00 hours

Resources Used

Fraction of Usage in Total Resources*1 (%): 0.20

Details

Computing Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage*2 (%)
SORA-MA	1,585,547.03	0.21
SORA-PP	864.95	0.01
SORA-LM	929.75	0.48
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage assigned(GiB)	Fraction of Usage*2 (%)
/home	476.84	0.33
/data	9,765.63	0.18
/ltmp	1,953.13	0.15

Archiver Resources		
Archiver System 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