Environment Conscious Aircraft Systems Research in Eco-wing Technology: Aerodynamic System Design Technology

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Abstract

Innovative drag reduction technologies are investigated to reduce the fuel consumption for a conventional aircraft configuration. Aircraft noise prediction technologies and the conceptual design technologies are also developed for future aircraft which achieve low noise and high efficiency.

Ref. URL: http://www.aero.jaxa.jp/eng/research/ecat/ecowing/

Reasons for using JSS2

CFD analysis are used for the understanding of aerodynamic characteristics and evaluation of the performance in the aircraft design phase. Huge calculation resources and costs were required for the high fidelity and quick response CFD analysis for the optimum aerodynamic design process on complex aircraft geometry. JSS2 can achieve those requirements, the cost and time are drastically saved on the CFD analysis.

Achievements of the Year

Aerodynamic design was performed on the wing geometry of TRA2022-3 configuration to reduce the drag on cruise flight condition. Comparing with TRA2022-2 configuration designed on 2017, further drag reduction was achieved by improvements of the natural laminar wing, pressure drag reduction airfoil and the downward rakelet wing tip design.

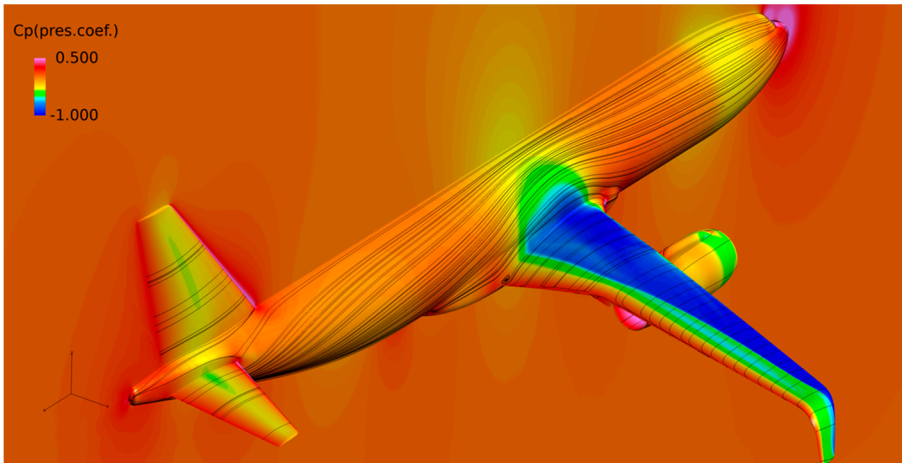

Fig. 1: Surface pressure distribution and surface flow pattern on TRA2022-3 configuration (M=0.78, CL=0.52)

Publications

- Oral Presentations

1. K. Kubota, K. Rinoie and T. Yuhara, Study on the Effects of Toe Angle of Upward Pointing and Downward Pointing Winglets, The Asia-Pacific International Symposium on Aerospace Technology (APISAT), 2018.

2. T. Yuhara, N. Tokugawa, D. Kwak, K. Ohira, S. Kondo, A Transonic Airfoil for Pressure-Drag Reduction and Its Application to Wing, 56th Aircraft Symposium, 2018. (in Japanese)

3. D. Kwak, T. Nomura, K. Ohira, Y. Ueda, Influence of Wing and Thrust Variations on the Fuel Consumption of subsonic aircraft, 56th Aircraft Symposium, 2018. (in Japanese)

4. H. Arizono, K. Ohira, Aerodynamics and Structural Design Studies for Main Wing on Subsonic Aircraft, The Asia-Pacific International Symposium on Aerospace Technology (APISAT), 2018.

Usage of JSS2

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	Automatic Parallelization
Number of Processes	15 - 1200
Elapsed Time per Case	100 Hour (s)

Resources Used

Fraction of Usage in Total Resources[*1] (%): 1.10

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2] (%)
SORA-MA	8,516,939.95	1.04
SORA-PP	200,777.77	1.60
SORA-LM	2,214.90	1.03
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2 (%)
/home	819.75	0.85
/data	86,143.80	1.52
/ltmp	18,820.54	1.61

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2 (%)
J-SPACE	11.02	0.39

[*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.