

Optimization of rotor blade

Report Number: R18ECMP11

Subject Category: Competitive Funding

URL: <https://www.jss.jaxa.jp/en/ar/e2018/9116/>

● Responsible Representative

Yasutada Tanabe, Senior Researcher, Aviation Systems Research Unit, Aeronautical Technology Directorate

● Contact Information

Yasutada Tanabe, Leader, High Speed Rotorcraft Research Section, Aviation Systems Research Unit, Aeronautical Technology Directorate, Japan Aerospace Exploration Agency (JAXA) (tan@chofu.jaxa.jp)

● Members

Yasutada Tanabe, Masahiko Sugiura, Hideaki Sugawara, Kuniyuki Takekawa

● Abstract

Search the optimized rotor blade for High-speed rotorcraft.

Ref. URL: <http://www.aero.jaxa.jp/eng/research/frontier/rotary/>

● Reasons for using JSS2

We execute CFD for rotor blade optimization. Because of many case, we used JSS2.

● Achievements of the Year

Before the search the optimized shape, we compared analysis based on Blade-Element-Theory (BET) and CFD to establish a correlation between them. As a result, CFD tends to show a higher L/DE (Lift by Effective Drag) and a lower figure of merit except few cases. (Fig. 1) General correlation between this simple method and the sophisticated CFD method is confirmed.

Next, initial samples generated by Hypercube distributions are evaluated. CFD result examples are shown in Fig. 2 and 3.

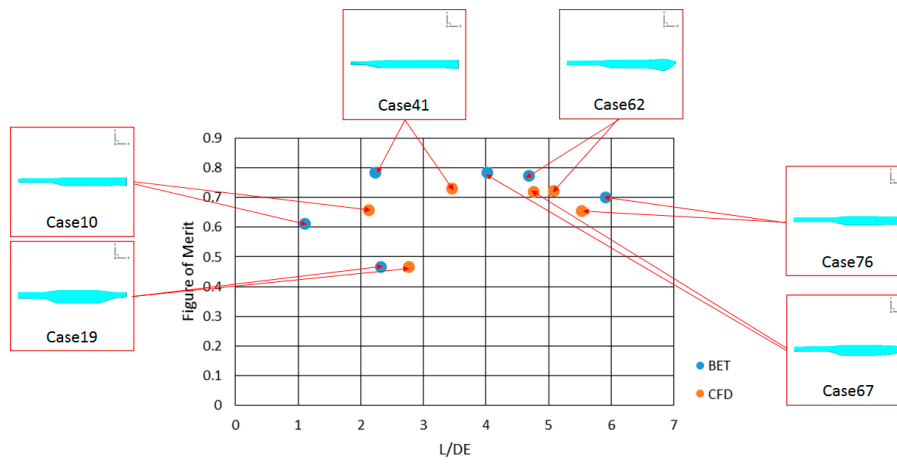


Fig. 1: Correlation between analyses based on simple Blade-Element-Theory and CFD for the evaluation of optimized rotors

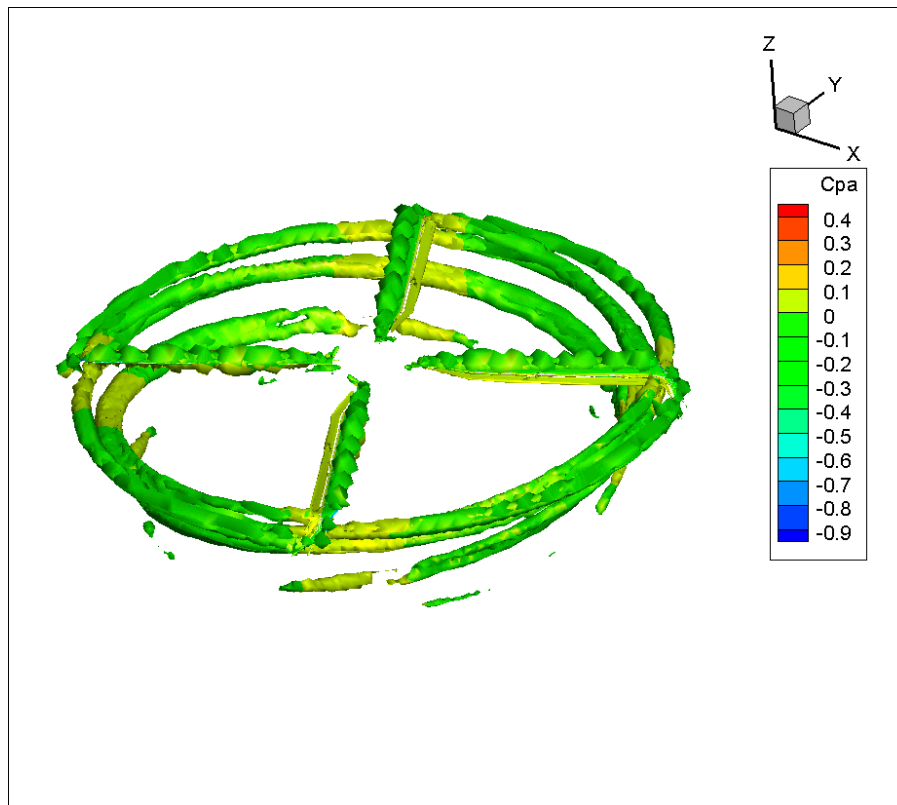


Fig. 2: Rotor wake in hovering flight

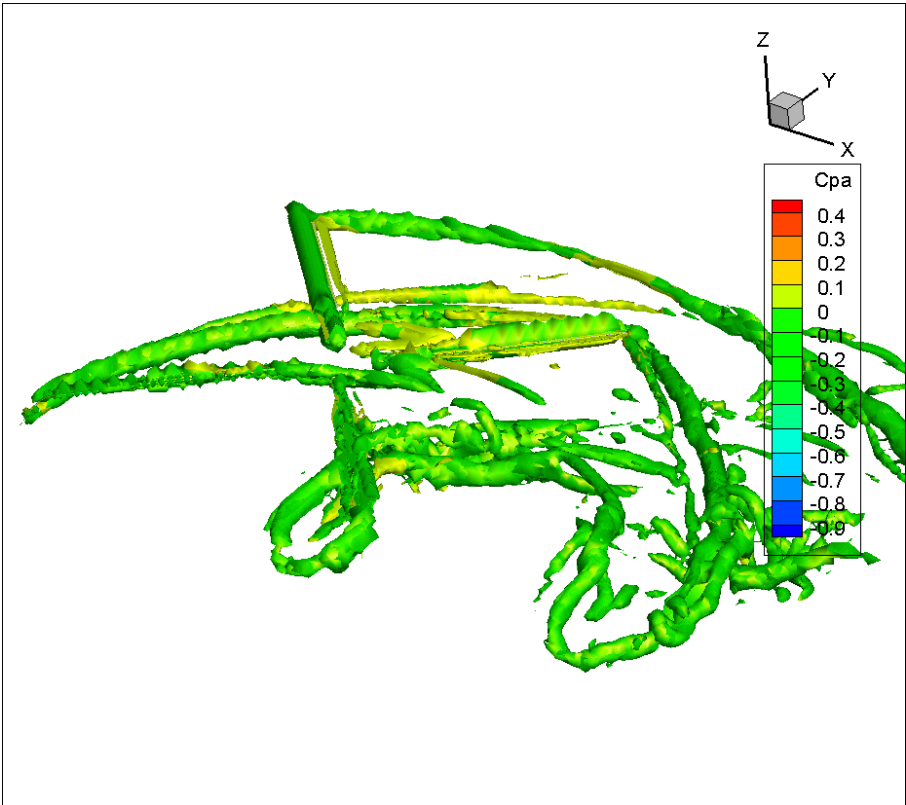


Fig. 3: Rotor wake in high advance ratio (0.7) forward flight

● Publications

N/A

● Usage of JSS2

● Computational Information

Process Parallelization Methods	N/A
Thread Parallelization Methods	OpenMP
Number of Processes	1
Elapsed Time per Case	430 Hour (s)

● Resources Used

Fraction of Usage in Total Resources^{*1} (%): 0.46

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage ^{*2} (%)
SORA-MA	1,324,397.81	0.16
SORA-PP	522,434.01	4.17
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	4,572.44	4.73
/data	7,398.20	0.13
/ltmp	937.11	0.08

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2 (%)
J-SPACE	7.94	0.28

^{*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.