



Near-field Pressure Signature Prediction by using TAS code and UPACS code



Hiroaki ISHIKAWA (TOUA) Yoshikazu MAKINO (JAXA)





I. Summary of cases analyzed

II. Flow solver / Computing platform

- ✓ Flow solver
 - TAS (Unstructured grid)
 - UPACS (Structured grid)
- ✓ Computing platform
- III. Grids
 - ✓ Provided grid
 - ✓ Unstructured/Structured overset method(Own grid)
- IV. Flow solver convergence
- V. Results
 - ✓ SEEB-ALR
 - ✓ 69deg Delta Wing
 - ✓ LM-1021
- VI. Conclusion



Summary of cases analyzed



	Not conv	/erged						
Configuration		Own grid						
	mixed element(TAS)				Tetrahedra	Structured	Overset	
	ExFine	Fine	Medium	Coarse	(TAS)	(UPACS)	(UPACS)	
SEEB-ALR	0	0	х	0		0	0	
69-Degree Delta Wing	0	0	0	0		0	0	
LM-1021	-	-	-	-	Δ	-	_ A	

Now calculating











I. Summary of cases analyzed

II. Flow solver / Computing platform

- ✓ Flow solver
 - TAS (Unstructured grid)
 - UPACS (Structured grid)
- ✓ Computing platform
- III. Grids
 - ✓ Provided grid
 - ✓ Unstructured/Structured overset method(Own grid)
- IV. Flow solver convergence
- V. Results
 - ✓ SEEB-ALR
 - ✓ 69deg Delta Wing
 - ✓ LM-1021
- VI. Conclusion





CFD solver

Solver	TAS	UPACS		
	Tohoku university Aerodynamic Simulation	Unified Platform for Aerospace Computation Simulation		
developer	Tohoku university & JAXA	JAXA		
Mesh	Unstructured mesh	Structured mesh		
	cell-vertex finite volume	cell-centered finite volume		
discretization scheme	HLLEW	AUSMDV		
spatial accuracy	2nd order	2nd order		
time integration	LU-SGS implicit method	MFGS implicit method		
Equation	Euler	Euler		

Computing Platform

JSS

- JAXA Super computing System
- Fujitsu FX1 (JSS M-system)
- Architecture: Scalar machine
- Processor Type = SPARC64 VII (4 cores/Processor)
- Processor/Node = 1 (4 cores/Node)
- Nodes/System = 3008 nodes
- Memory/Node = 32GB (Shared memory in a node)
- Memory/System = 94TB (Distributed memory among the nodes)
- Peak Performance = 120TFlops



2-33 processors(nodes) used







- I. Summary of cases analyzed
- II. Flow solver / Computing platform
 - ✓ Flow solver
 - TAS (Unstructured grid)
 - UPACS (Structured grid)
 - ✓ Computing platform
- III. Grids
 - ✓ Provided grid
 - Unstructured/Structured overset method(Own grid)
- IV. Flow solver convergence
- V. Results
 - ✓ SEEB-ALR
 - ✓ 69deg Delta Wing
 - ✓ LM-1021
- VI. Conclusion



Str./Unstr. Overset method







Structured grid can be generated easily and automatically without much working load and negative cell volume detection.







- I. Summary of cases analyzed
- II. Flow solver / Computing platform
 - ✓ Flow solver
 - TAS (Unstructured grid)
 - UPACS (Structured grid)
 - ✓ Computing platform
- III. Grids
 - ✓ Provided grid
 - ✓ Unstructured/Structured overset method(Own grid)

IV. Flow solver convergence

- V. Results
 - ✓ SEEB-ALR
 - ✓ 69deg Delta Wing
 - ✓ LM-1021
- VI. Conclusion





Not converged

	Spec.	Provided grid					Own grid	
Configuration			mixed ele	ment(TAS)		Tetrahedra	Structured (UPACS)	Overset
		ExFine	Fine	Medium	Coarse	(TAS)		(UPACS)
SEEB-ALR	Resolution	0.80	1.00	1.56	2.00			from Ex.Fine
	# Nodes	10.2M	5.3M		0.7M		8.0M	26M
	# Process	33	17		2		19	15
	CFL	1	1		1		100	100
	Iteraton	26K	27K		25K		10K	8.7K
	Elapse time	100h	80h		70h	unstable	2h	7.5h
69-Degree Delta Wing	Resolution	1.00	1.25	1.56	2.00			from Ex.Fine
	# Nodes	5.4M	2.7M	1.4M	0.7M		10.6M	26M
	# Process	17	9	5	3		12	15
	CFL	100	100	100	100		100	100
	Iteraton	4.2K	3.1K	3.7K	4.0K		5.0K	17.3K
	Elapse time	20h	14h	14h	12h		2h	15h
LM-1021	# Grid pts.					2.4M		from Tetra.
	# Process					↓ 10		15
	CFL					1		100
	Iteraton							
	Elapse time							











- I. Summary of cases analyzed
- II. Flow solver / Computing platform
 - ✓ Flow solver
 - TAS (Unstructured grid)
 - UPACS (Structured grid)
 - ✓ Computing platform
- III. Grids
 - ✓ Provided grid
 - ✓ Unstructured/Structured overset method(Own grid)
- IV. Flow solver convergence
- V. Results
 - ✓ SEEB-ALR
 - ✓ 69deg Delta Wing
 - ✓ LM-1021
- VI. Conclusion















Results(69deg-Delta)

SST Team

2















Now calculating







• Near-field pressure signatures are predicted.

Model

- SEEB-ALR, 69deg Delta Wing, (LM-1021)

CFD codes

- TAS code (Unstructured grid)
- UPACS code (Structured grid)

Grids

- Provided grids (mixed-element, structured grid)
- Own grids for overset structured grid

Results

- All results have almost same tendency.
- High resolution grids of mixed-element have the sharp near-fields pressure signature.
- Overset structured grid method can be reduced the computational time.