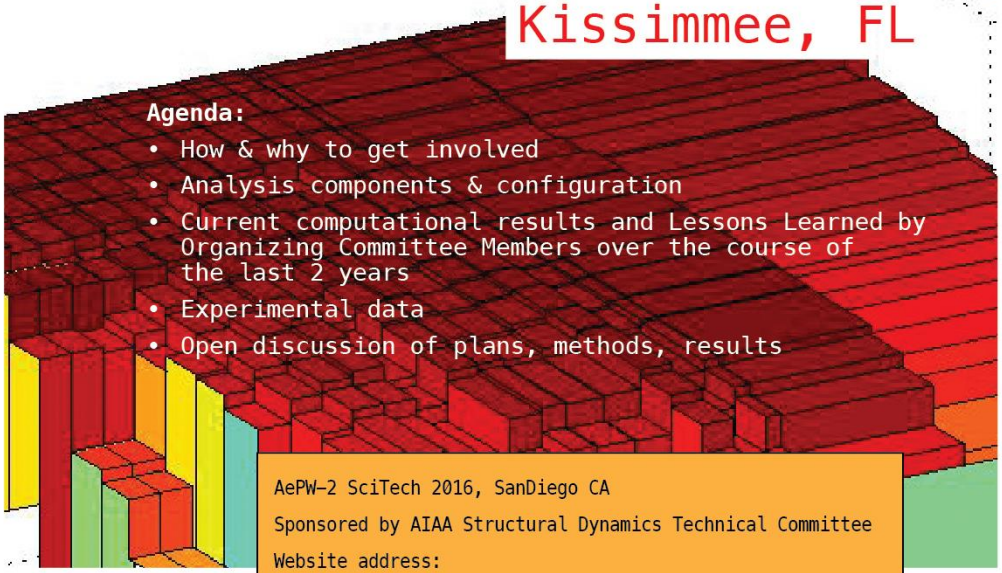
Kickoff Meeting for the 2nd AIAA Aeroelastic Prediction Workshop

Monday January 5, 2015
1900 – 2100 hrs
Room: Emerald 4

AIAA SciTech 2015
Kissimmee, FL



Agenda:

- How & why to get involved
- Analysis components & configuration
- Current computational results and Lessons Learned by Organizing Committee Members over the course of the last 2 years
- Experimental data
- Open discussion of plans, methods, results

AePW-2 SciTech 2016, SanDiego CA

Sponsored by AIAA Structural Dynamics Technical Committee

Website address:

March telecon summary

- **Website address: http://nescacademy.nasa.gov/workshops/AePW2/public/**
- Held on March 12, rather than March 5 (with the usual March daylight savings time issues)
- Next telecon April 2, 11 a.m. East Coast time in U.S.
- SU-2 doesn't have existing FSI capability.(Melike and Dave Schuster to talk about this?)
- Block-structured grids from AePW-1 are available, generated by Thorsten Hansen at ANSYS. (Thorsten and Pawel will work together to make those available on the new website.)
- The molecular weight of R-134a isn't the same as a standard property table shows (102 g/mol). The value derived using the listed properties is more like 98 g/mol. This is due to the practical issue of gas purity that is achieved in the wind tunnel. The values on the table are from the test data, where the purity was likely 95%'ish. (Pawel will add a line for molecular weight to the analysis parameters table.)
- Add the following to the table of analyses:
  - ATA Engineering (Eric Blades will run LoPsiChem)
  - AFRL (Rick Graves will run FUN3D)
  - Milano Polytechnico (Sergio Ricci will run numerous codes)
- Please send comments regarding the distributed slides. In particular, are you okay with the abstract submittal form?
- With regard to submitting data to the workshop for comparison:
  - Can you provide results in matlab?
  - How do you feel about providing them in a data structure in matlab?
- Doublet lattice aeroelastic solution results:
  - Bimo and Jen will work to present the results to date at the next telecon
  - We will put the bulk data file, including the aero model and the flutter cards on the web site. This can serve as a basis for those who might want to use correction methods, etc.
- Temporal convergence results
  - Organizations may not have the resources to perform the temporal convergence study for all grids. It is suggested that this be done for a grid resolution where things look to be spatially converged. Experience at NASA has shown qualitatively different results for the unstructured coarse grid than those observed for the finer grid resolutions.
  - The flutter results at low Mach number (Mach 0.74) have shown great variation with regard to time step size. The predicted aeroelasticity stability of the system has been shown to be a function of the time step size and the subiteration convergence level.

We invite you to participate

Participation is unrestricted

Important Dates

- Kickoff Meeting: SciTech 2015
- Workshop: SciTech 2016
- Computational Results Submitted by Nov 15, 2015
- Computational Team Telecons: 1st Thursday of every calendar month 11 a.m. EST

March telecon notes, premeeting

- **TELECON had to be rescheduled due to technical difficulties. March telecon rescheduled for March 12.**
- Review Feb telecon notes
- Review developments since Feb telecon
- Analysis results, issues that analysts want to discuss

- Note: following the end of the telecon, as the webex window was closing… it was noted that there were some questions and/or comments on the webex communication window. Apologies for not noticing them. The window closed before we could stop it. We are not smart enough to figure out the now-erased questions. Can you ask them again?

- Putting items on the agenda and into the meeting slides:
  - You can send me anything that you want, but unless you say that you want it distributed, I generally won't put the information into the pre-meeting slides.
- Address how to officially sign up

- Next telecon April 2, 11 a.m.

Feb Telecon Notes

- Attendees list (to be added)
- Suggested adding to website:
  - Participating teams and matrix with contact information
  - Experimental data (Action item taken by Jen.)
- Request made that the frequency response function information be available in both rectangular form (Re and Im components) as well as in polar (Mag and phase) form. (Action item taken by Jen.)
- Experimental results for Case 1. In the FRF magnitude, there is a sawtooth near the leading edge. What is the source of that? Physical? Sensor issue? (Action item taken by Jen.)
- Grids: structured grids were generated by NASA in plot3D format using Pointwise. The gridding guidelines still include the RSW and HIRENASD from AePW-1. Need to revise them so that they are not confusing. Revisit them also with regard to the Reynolds number.
- Nonlinear effects and LCO:
  - Discussion regarding hysteresis and identification of the neutral stability point
  - Discussion about experimental data sets, including a DLR study on LCO where there were trends with Mach number
- Process:
  - Think about what questions we are trying to answer
  - How do we tell the organizing committee that we are participating by performing analyses? Is there a website sign up or abstract submittal form that we mail?
- Note: following the end of the telecon, as the webex window was closing… it was noted that there were some questions and/or comments on the webex communication window. Apologies for not noticing them. The window closed before we could stop it. We are not smart enough to figure out the now-erased questions. Can you ask them again?
- Next telecon March 5, 11 a.m.

Developments since the February Telecon

- AePW-2 website corrections: (thanks for Pawel for correcting these; thanks to Eric Blades for pointing these out)
  - Analysis Parameters Table was corrected for density and static temperature.
  - Cell-centered medium grid tar file was corrupted and new file was uploaded.
- Website additions:
  - Files with mode shapes in Tecplot ascii format were uploaded on the website for some grids.
- Doublet lattice aeroelastic analyses performed by Bimo Pranata at NLR, with minor participation from Jen Heeg at NASA
  - Are the test cases challenging enough? Do we want to add more?
- RANS + SA analysis run for Case 1 by Sabari Girish and Kartik Venkatraman (Experimental data sent to them this morning)

Updated analysis parameters table (updated on website March 3, 2015)

Corrections that were made to this table

Parameter	Symbol	Units	[illegible]	[illegible]	[illegible]
Mach	M		0.7	0.74	0.85
AoA	α	deg	3°	0°	5°
Reynolds number (based on chord)	Re_c		3.418×10^6	4.450×10^6	4.491×10^6
Reynolds number per unit length	Re	Re_c/ft	2.564×10^6	3.338×10^6	3.368×10^6
Dynamic pressure	q	psf	170.965	168.800	204.197
Velocity	V	ft/s	387.332	375.700	468.983
Speed of sound	a	ft/s	[illegible]	[illegible]	[illegible]
Static temperature	T_{stat}	F	85.692	89.250	87.913
Density	ρ	$slug/ft^3$	0.00228	0.002392	0.001857
Ratio of specific heats	γ		1.113	1.136	1.116
Dynamic viscosity	μ	$slug/ft-s$	2.58×10^{-7}	2.69×10^{-7}	2.59×10^{-7}
Prandtl number	Pr		0.683	0.755	0.674
Test medium			R-134a	R-12	R-134a
Total pressure	H	psf	823.17		757.31
Static pressure	p	psf	629.661		512.120
Purity	X	%			95
Sutherland's constant	C	R	438.07	452.13	438.07
Reference viscosity	μ_{ref}	$lb-sec/ft^2$	2.332×10^{-7}	2.330×10^{-7}	2.332×10^{-7}
Reference temperature	T_{ref}	R	491.4	491.4	491.4

Mini-abstract from AePW-1

MRL and USF Contribution to AePW - 1

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We intend to participate in the AePW-1, to be held April 21-22 2012 in Honolulu, HI. We plan to perform the following sets of computations:

Configuration 1 – RSW , Steady Case, i. M=.825, α=2 deg
Code: RANS-CFD-3D
Grid: Str-OnetoOne-C-v1 (supplied by AePW-1 committee)
Turbulence model: Menter SST

Configuration 1 – RSW , Unsteady Case, i. M=.825, α=2 deg, 10 Hz Same as above

Configuration 2 – BSCW, Steady case, M=.85, α=5 deg, 10 Hz Same as above

Configuration 2 – BSCW, Unteady case, M=.85, α=5 deg, 20 Hz Same as above

Configuration 3 - HIRENASD Configuration, steady, M=.8, Re=7 million, α =1.5 deg
Code: RANS-CFD-3DAe
Grid: Str-OnetoOne-C-v1 (supplied by AePW-1 committee)
Turbulence model: S-A

We plan to submit our results electronically by the March 20, 2012 deadline to the AePW-1 committee. RANS-CFD-3DAe is a Reynolds-averaged Navier-Stokes code developed by Et et al.,[1] widely used at the Multielement Research Lab. It is specifically formulated to work on three-element wing configurations. It uses point-matched grids, and is an upwind finite-volume structured code.
LES-CFD-3D is a large-eddy simulation code developed at the University of Southern Flight.[2] It employs 6th order central differencing in space and 3rd order temporal differencing, along with 9th order explicit filtering.

References

Et, H., Cet, P., and Era L., “Description of RANS-CFD-3D,” Journal of Codes, Vol. 6, No. 5, 1994, pp. 5– 21.
Author, A. and Author B., “Description of LES-CFD-3D,” Journal of Lengthy Papers, Vol. 9, No. 2, 2008, pp. 22–1021.

_ Corresponding Author. Senior Research Scientist, High Lift Branch.
† Professor and Chair, Dept. of Aeronautical Engineering.

AePW-2 Analyses/Commitments so far….

Analysis Team	Code	Case 1	Case2	Case3
Technion - IIT	EZNSS	✓	✓	?
FOI	EDGE	✓	✓	?
NASA	SU2	✓	✓	?
NASA	FUN3D	✓	✓	✓
NASA	FUN3D / 2D	✓	✓	
NLR/NASA	NASTRAN (doublet lattice aero)	✓		
Indian Institute of Science	FLUENT	✓		