

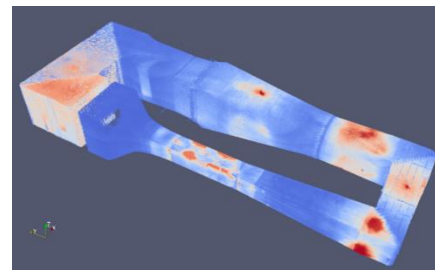
VT-ONR-NATO Activity: AVT-387 Common Research Wind Tunnels for CFD Verification and Validation

An Experimental/Computation Study to Understand Requirements for Modeling Wind Tunnel Flow

Virginia Tech, with support from the Office of Naval Research, is part of NATO AVT-387, focused on wind tunnel modeling and simulation requirements. The primary goal of the project is to quantify the geometrical, modeling, and mesh-related uncertainties in wind tunnel simulations. The project is broken up into two steps, first step being the empty wind tunnel case and the second step being the case with a model in the wind tunnel test section. VT's Stability Wind Tunnel (SWT) facility is one of four facilities chosen for this effort. Currently the SWT is equipped with more than 500 pressure sensors and the capability to perform detailed flow field and boundary layer measurements. For this project, the SWT will compile the data of over 100 experimental runs with the help of undergraduate and graduate students. We plan to publish a systematically-refined family of grids for as-built and as-designed meshes to be used for computations. To collaborate on this research, VT would like to invite computers to use CFD solvers of their choice to obtain solutions for the empty wind tunnel case and the model-in-tunnel case. These CFD solutions will be compared with each other and against experimental data at NATO AVT meetings. As of now, AVT-387 has had a first round of CFD-to-CFD comparisons. Currently we have 8 computational teams from around the world interested in computing this case.



Pressure Contour for the high-speed leg



Wind Tunnel Geometry

Latest Participation and Involvement

- As-designed mesh files available for four systematically-refined grids
- Meeting held for AVT-389 participants in Sweden for first round of comparison of as-designed CFD to CFD solutions
- Detailed experimental measurements for boundary conditions and reference values

Timeline

- *November 2023:* Additional family of 7 systematically-refined grids
- *January 2024:* Collect additional experimental validation data for the empty test section case
- *January 2024:* Contributors submit computational results to VT for compilation and analysis
- *March 2024:* As-built grids released for computational use.
- *May 2024:* Meeting for comparison of as-designed CFD solutions to experimental data
- *May 2024:* Computer submissions for the as-built CFD solutions.



VT Stability Wind Tunnel Web Site: www.aoe.vt.edu/research/facilities/stabilitytunnel
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