C3.8 Common Research Model (DPW-5)

[source: http://aaac.larc.nasa.gov/tsab/cfdlarc/aiaa-dpw/]

General

The common research model (CRM) is a wing-body configuration which was extensively studied with state-of-the-art CFD codes in the fifth drag prediction workshop (DPW-5) [http://aaac.larc.nasa.gov/tsab/cfdlarc/aiaa-dpw/].

The CRM is considered under transonic cruise conditions. The flow is assumed to be steady-state and fully turbulent. Computations are to be performed in a target lift mode, i.e., given a specified lift coefficient, the corresponding angle of attack has to be determined. The objective of the simulations is to obtain mesh-converged drag and moment coefficient values as well as pressure distributions in sections along the wing span.

Flow Conditions and Parameters

This study corresponds to the first test case of DPW-5.

- Mach = 0.85
- $C_L = 0.500$ (± 0.001)
- Re = 5×10^6 based on reference chord c_{ref} = 275.80 inch
- moment reference center at x_{ref} = 1325.90 inch, z_{ref} = 177.95 inch

- reference area (half model) for coefficient computations: $A_{ref} = 297360$ (inch)^2
- fully turbulent flow, no transition
- steady-state RANS
- free air farfield boundaries, no modeling of support structures or wind tunnel walls

Meshes

A series of nested structured multi-block meshes has been generated for DPW-5 (cf. AIAA Paper 2011-3508 [http://aaac.larc.nasa.gov/tsab/cfdlarc/aiaa-dpw/Workshop5/AIAA.2011-3508.pdf]) and is available in various formats as well as converted to several unstructured meshes including split elements.

The original sequence of structured meshes can be converted to high-order meshes with quartic edge representation, but these meshes exhibit strong oscillations at the wing tip and fairing-body junction. An alternative mesh has been provided by Marco Ceze, University of Michigan. The hexahedral mesh uses a piecewise cubic representation and thus a good geometry resolution, even though it is coarse enough (80k elements) to serve as starting point for adaptive algorithms. It is provided in GMSH format.

For reasons of comparability, all participants are motivated to use the provided mesh for computations. Computations on a mesh sequence should be performed by uniform refinement of the initial mesh. If participants cannot refine the mesh in their own codes, finer versions of the baseline mesh can be provided upon request.

Additional information

Geometry reference for the CRM:

- JC Vassberg, MA DeHaan, SM Rivers, and RA Wahls, "Development of a Common Research Model for Applied CFD Validation Studies", AIAA Paper 2008-6919, AIAA Applied Aerodynamics Conference, Honolulu, HI, August, 2008

For further information, please refer to the DPW-5 website and the references cited therein. [http://aaac.larc.nasa.gov/tsab/cfdlarc/aiaa-dpw/]