Topic 1: Flap Deflection Studies

Purpose To determine the requirements for accurate prediction of performance changes with angle of attack (KQ 7, plus potentially aspects of 9 and 10).

Starting points

- Compute a partial α-sweep (not too near $C_{L,\max}$)
- Repeat for (at least some) angles of attack and determine change in aerodynamic coefficients

Supporting pieces

- Flap deflection meshes (probably level C meshes for these; in process)

Comments

- This topic is an ideal choice for participants with limited computational resources and those who are new to high lift simulations

Topic 2: Drilling Down on Impact of Solver Choices

Purpose To study the impact of decisions made about discretizations, solver settings, etc (KQ 11 from a different angle)

Starting points

- Compute one or more cases from the Topic 1 and compare results between solvers
- Identify solver features and settings ((type of gradient calculation, artificial dissipation, or invisicid flux function, for instance) that impact the solution

Supporting pieces

- Reference solutions, both on the mesh level(s) used for the study and a finer mesh level ($\geq$D) using a well-verified solver

Comments

- This topic will hopefully shed some light on why different solvers give significantly different answers on the same mesh.

Topic 3: Mesh Sensitivity

Purpose To study systematically where the solution is highly sensitive to mesh resolution (KQ 2 and 3, with implications for the future for 4, 7–11)

Starting points

- Compute primal and adjoint solutions
- Produce modified meshing guidelines and generate new meshes? (aspects of KQ 1, 6)

Supporting pieces

- Potentially, close interaction with meshing participants

Topic 4: Effects of Turbulence / Transition Model Choices

Purpose To study the impact of turbulence and transition modeling on aerodynamic predictions, especially near stall (KQ 8, and aspects of 9)

Starting points

- Compute one or more flow conditions and compare results between turbulence models.
- To reduce solver dependency, ideally compare models implemented in the same solver, with the same solver settings.
- Identify regions of the flow where models give differing results.

Comments

- Perhaps coordinate with LES / wall-modeled LES TFGs for comparison data.

Topic 5: Solution Strategies

Purpose To study the impact of convergence trajectory on high lift simulation results (KQ 10 and 11)

Starting points

- α-sweep from low to high (past stall) and back down again, restarting from previous α solution.
- Repeat with freestream initial conditions
- Look at impacts of global vs. local time step; steady vs. unsteady simulation; different convergence accelerations strategies; etc

Comments

- This is going to involve a lot of simulations. Consider whether B or C meshes are the appropriate choice.

Key Questions

1. How can meshing guidelines be prescribed so that geometrically similar meshes are generated?
2. What are the meshing resolution requirements and best practices/guidelines for different regions of the lift curve?
3. How do we accurately, consistently, and clearly prescribe wake resolution requirements?
4. Can a single mesh produce consistently accurate results for all angles of attack?
5. What are current best practices for remeshing due to component movement?
6. What roadblocks or limitations exist in our current capabilities for remeshing?
7. Can RANS modeling accurately predict the influence of component movement at moderate angles of attack?
8. Can RANS modeling accurately predict CL,max?
9. At what angles of attack are steady-state RANS simulations appropriate?
10. How much error and uncertainty is associated with underconvergence of the solution residual?
11. What is the effect of solution strategy (e.g. global CFL condition, global time stepping, quasi-Newton, initial conditions, etc.) on the predictions?