3rd Geometry and Mesh Generation Workshop 4th CFD High Lift Prediction Workshop

Day 1: Introduction

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For working team progress meeting; PRELIMINARY ONLY

Objectives of Progress Meeting



- 1. Share and discuss results and provide status of individual TFG efforts
- 2. Integrate lessons learned (to date) across TFGs, where possible
- 3. Help focus efforts towards January in-person workshop

Introduction



- HLPW-4/GMGW-3 is scheduled for January 7, 2022 in San Diego.
- This workshop is different from others in the past: 6 Technology Focus Groups (TFGs) have been tasked to perform collaboratively, trying to answer "Key Questions" of importance to predicting high-lift flows.
 - G: Geometry & Mesh preparation (GEOM TFG)
 - R: Fixed-mesh RANS (RANS TFG)
 - A: Mesh adaptation for RANS (ADAPT TFG)
 - H: High-order discretization (HO TFG)
 - L: Hybrid RANS-LES (HRLES TFG)
 - W: Wall-modeled LES and Lattice-Boltzmann (WMLESLB TFG)
- This progress meeting is for *preliminary* assessment, providing some guidance leading into the final months of work.

Test Cases



- Case 1 Flap Deflection Study (AoA=7.05°)
 - Nominal flap setting of 40/37 deg. (inboard/outboard) vs. 37/34 and 43/40
 - Case 1a comparison with wind tunnel data (data from 37/34 and 43/40 have been *blind* prior to today)
 - Case 1b grid convergence study for 40/37 deg. at AoA=7.05° in free air
- Case 2 $C_{L,max}$ Study (full polar)
 - Case 2a Free air computations with comparisons to corrected data
 - Case 2b In-tunnel computations with comparison to uncorrected data
- Case 3 Verification Study
 - 2-D 3-element CRM-HL airfoil section from NASA TMR website: VERIF/2DMEA

Geometry Modeling TFG Test Cases



- Challenge A: Build the complete nominal CRM-HL configuration geometry
- Challenge B: Build the CRM-HL flap deflection geometries
- Challenge C: Generate best practice surface meshes and identify geometry-related meshing issues
 - Nominal CRM-HL
 - Sonic Boom C608
- Challenge D: Incorporate 3D scan data in the generation of a surface mesh suitable for CFD

Geometry

- High Lift Common Research Model (CRM-HL)
- Geometry Modeling TFG produced IGES and STEP geometry files for use by workshop participants:
 - CRM-HL
 - Nominal Configuration
 - Inboard/outboard flap angles of 40/37 degrees
 - Off-Nominal Configurations
 - Inboard/outboard flap angles of 37/34 degrees
 - Inboard/outboard flap angles of 43/40 degrees
 - Farfield Definition
 - CRM-HL Boundary-Layer Tripping Information from Qinetiq Test
- Additional geometry files used by TFGs for test cases:
 - 2D CRM-HL and 2D 30P-30N multi-element airfoils
 - Juncture Flow Model
 - Sonic Boom C608



Fixed Grid RANS Committee Meshes



- Nominal Configuration
 - Unstructured: All Tets (Levels A-D)
 - Unstructured: Prism Tet (Levels A-D)
 - Unstructured: Hex Tet (Levels A-D)
 - Structured Overset (Levels A-D)
 - Structured Overset (Level A) (wall spacing @ y+=1.0)
- Inboard/outboard flaps @ 37/34 degrees
 - Unstructured: All Tets, Prism-Tet, Hex-Tet (Level D)
- Inboard/outboard flaps @ 43/40 degrees
 - Unstructured: All Tets, Prism-Tet, Hex-Tet (Level D)
- Additional meshes generated by TFGs with different meshing requirements.

Agenda



- Day 1 Individual TFG Presentations (~30 min each)
 - Geometry Modeling and Preparation for Meshing
 - Fixed Grid RANS
 - Short Break
 - Mesh Adaptation for RANS
 - Hybrid RANS/LES
 - Short Break
 - High Order Discretization
 - Wall-Modeled LES and Lattice-Boltzmann
- Day 2 Summary and Discussion
 - Global Summary (45 min)
 - Open Discussion (1.5 hour)