Tuesday, 8 April 2025

ASSIGNMENT-4: MODIFICATION OF THE PYTHON WRAPPER SETUP

This test case implements a Python-controlled spatially varying wall temperature boundary condition for a steady-state compressible turbulent flat plate simulation using SU2 v8.1.0. The configuration utilizes the Spalart-Allmaras (SA) turbulence model to simulate the flow over a flat plate with length 0.01687 units.

CONFIGURATION DETAILS:

1. Temperature Profile:

    Wall temperature varies linearly from 300K to 500K along the plate's length.
    Implemented through the Python wrapper using:

    Temperature = 300.0 + 200.0 * (x_coord/plate_length)

    Temperature bounds are physically constrained between 300K and 500K.

2. Solver Configuration:

    RANS solver with SA turbulence model
    Steady-state simulation (TIME_MARCHING=NO)
    Roe scheme with MUSCL reconstruction
    Euler implicit time discretization
    Adaptive CFL number (5.0 initial value)

3. Boundary Conditions:

    plate: (MARKER_PYTHON_CUSTOM)
    farfield: Standard farfield boundary condition
    No inlet/outlet required (simple flat plate case)
    Isothermal reference temperature of 300K

4. Mesh Characteristics:

   - 2D structured mesh
   - 16,600 quadrilateral elements
   - 16,800 grid points
   - 200 boundary elements on plate surface
   - Physical dimensions: 0.01687 (length) × 0.00149269 (height)

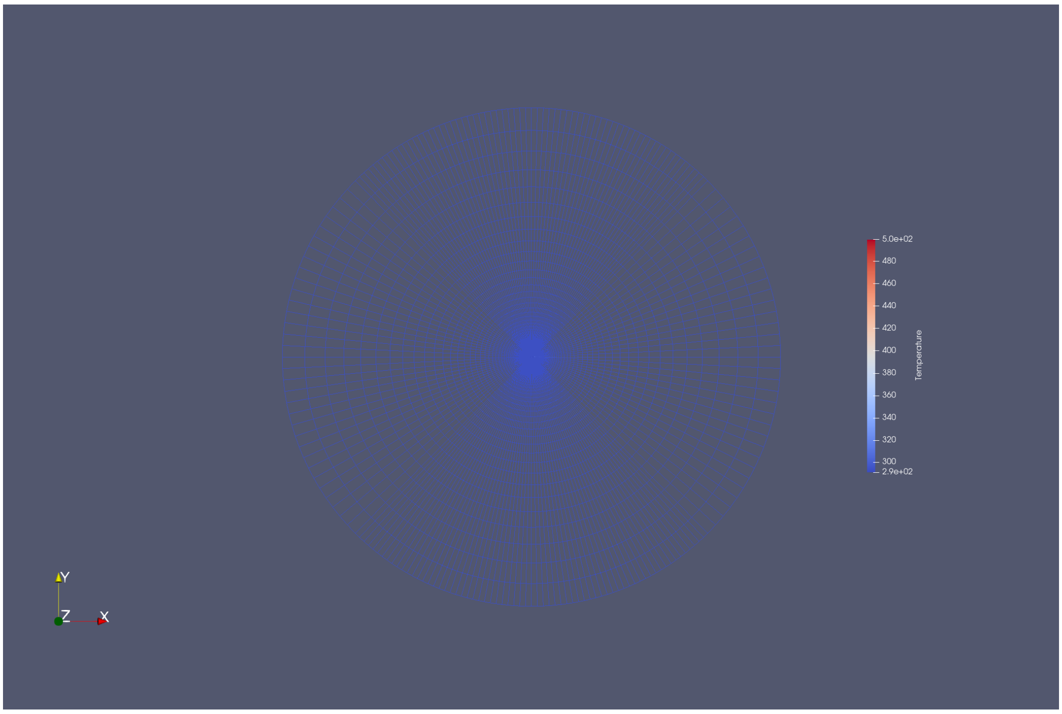
5. Numerical Parameters:

   - Reynolds number: 5×10^6 (based on plate length)
   - Mach number: 0.2
   - Reference pressure: 101325 Pa
   - Freestream temperature: 293.15 K
   - Sutherland's law for viscosity

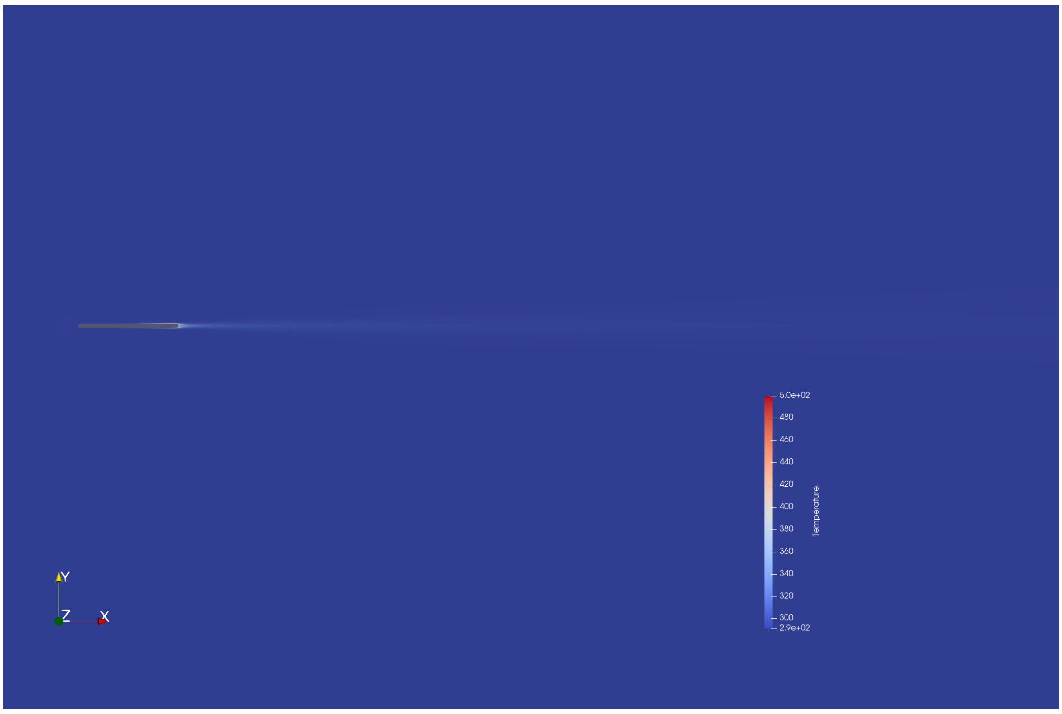
6. Output Configuration:

   - Monitoring of RMS density and turbulence residuals
   - Surface and volume output in VTU format
   - History file recording iterations and forces

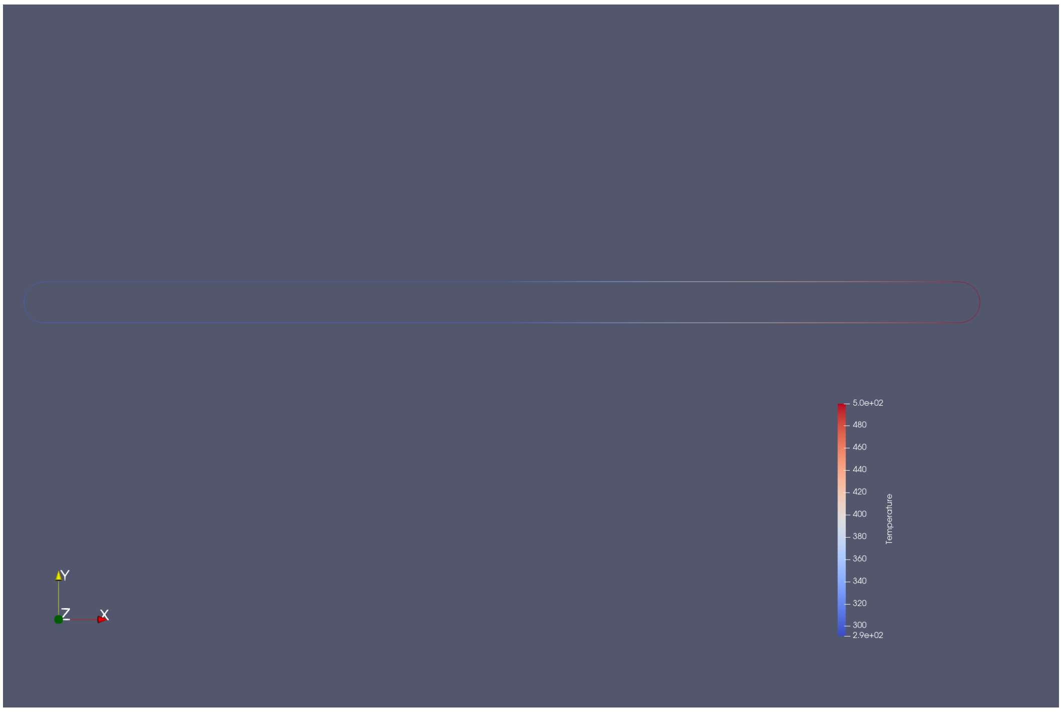
OUTPUTS:



Showing spatially varying temperature in WIREFRAME view



Showing spatially varying temperature in SURFACE view



Showing spatially varying temperature in FEATURE EDGE view