Tuesday, 8 April 2025

ASSIGNMENT-2: SET UP A TEST CASE

This assignment focused on the development and execution of a 2D axisymmetric simulation of a steady, turbulent jet using SU2. A structured mesh was generated using Gmsh to accurately capture the flow domain geometry. Following this, a detailed configuration file was prepared to define the solver settings, boundary conditions, and numerical schemes.

The simulation was performed using the Reynolds-Averaged Navier-Stokes (RANS) equations with the SST turbulence model, appropriate for capturing the jet's turbulent mixing behavior. The setup was defined as an axisymmetric, steady-state, compressible flow, solving a direct problem formulation.

Post-processing was conducted using ParaView to analyze key flow features such as velocity and temperature distributions. This exercise provided practical experience in mesh generation, SU2 configuration, solver execution, and the interpretation of CFD results, while also enabling comparison with experimental reference data for validation.

CONFIGURATION DETAILS:

1. Inlet Boundary Conditions:

    Type: Total pressure/temperature inlet (MARKER_INLET)

    Parameters:

        Total Temperature (T_t): 300.0 K

        Total Pressure (P_t): 102500.0 Pa

        Flow Direction: (1.0, 0.0, 0.0)

        Pure axial flow (X-direction), no radial/swirl components.

        Turbulence Specifications (MARKER_INLET_TURBULENT):

        Turbulence Intensity (Tu): 1% (set via 0.01 in the config)

        Eddy Viscosity Ratio (v_t/v): 3.0

2. Outlet Boundary Condition:

  Type: Static pressure outlet (MARKER_OUTLET)

  Parameter:

    Back Pressure (P_s): 101325.0 Pa (standard atmospheric pressure)

3. Symmetry/Axis Boundary:

  Type: Symmetry plane (MARKER_SYM)

  (Applied to: Centerline (axis of rotation for axisymmetric simulation))

4. Far-Field Boundary:

  Type: Far-field (MARKER_FAR)

  (Behavior: Acts as a non-reflective boundary for external flow.)

5. Isothermal Wall (Optional)

  Type: Isothermal wall (MARKER_ISOTHERMAL)

  Parameter:

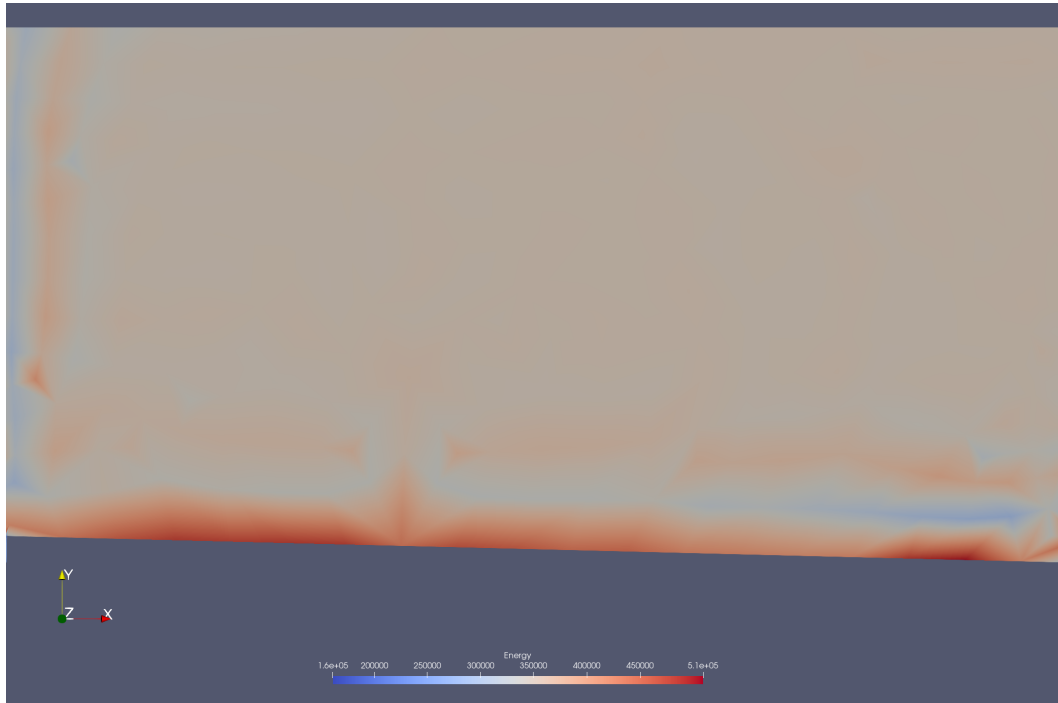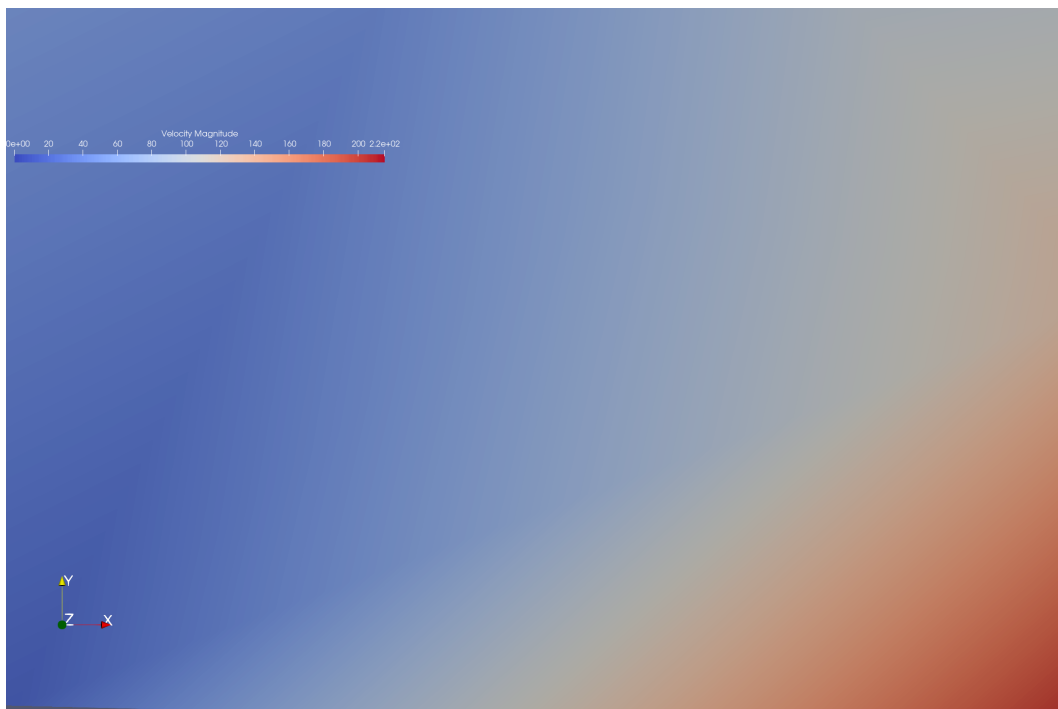   Wall Temperature (T_wall): 300.0 K (matches inlet temperature)

OUTPUTS:

Temperature

Momentum Magnitude

Energy

Velocity