Project – 2

Flow in a diffuser

The objective is to simulate the flow in a diffuser using the python scripting in ANSYS PyFluent. The learning objectives are –

Develop the python script for ANSYS Watertight meshing workflow with following steps –

- Import the geometry
- Local size refinement (BOIs)
- Generate the surface mesh
- Define geometry
- Update regions
- Add boundary layer – (by last ratio method)
- Generate the volume mesh – (change the mesh size)
- Extrude the mesh – (develop the script to extrude the mesh)

For the Fluent solver –

- Viscous model selection
- Adding materials (other than default)
- Adding the boundary conditions
- Initialization
- Solving the problem
- Plotting the contours using PyFluent Core
- Plotting the pressure and wall shear stress along a surface

CAD model -
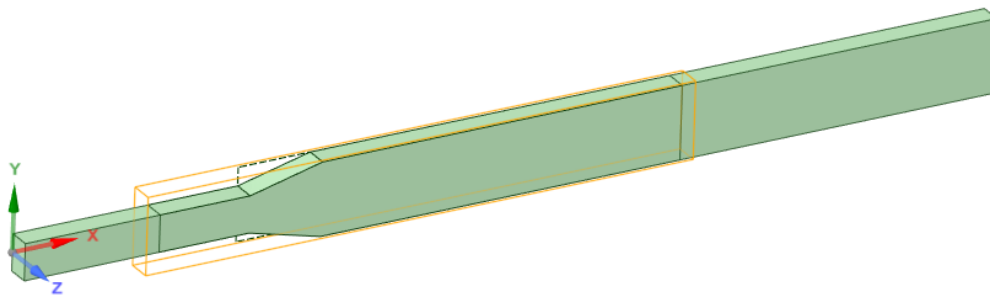
Geometric dimensions –

- Inlet height – 40 mm
- Outlet height – 80 mm
- Thickness - 25 mm
- Total length (upstream of diffuser) – 250 mm
- Horizontal length the diffuser section – 80 mm

Name – Swadesh Suman
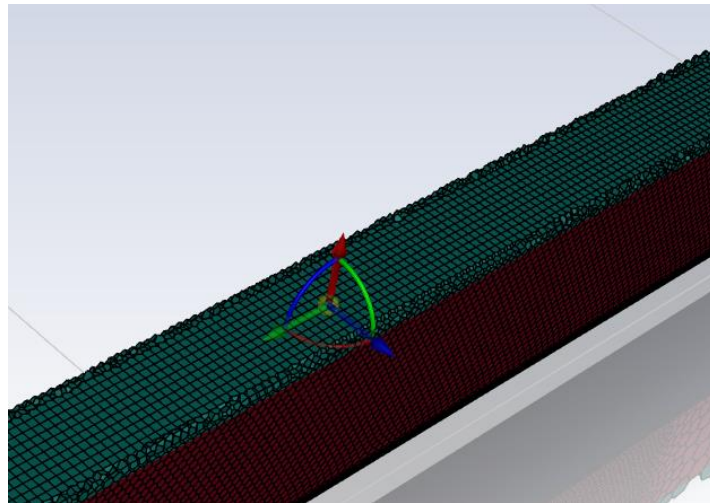Mail – swadesh.suman@mail.mcgill.ca

- Total length (downstream of diffuser) = 800 mm
- BOI length (in upstream of diffuser) – 100 mm
- BOI length (in downstream of diffuser) – 400 mm
- Outlet extruded length = 100 mm

Meshing Images –

Mesh parameters can be found in the python script available in github.

Minimum orthogonal mesh quality – 0.41, Total mesh count - 208342

Name – Swadesh Suman

Mail – swadesh.suman@mail.mcgill.ca
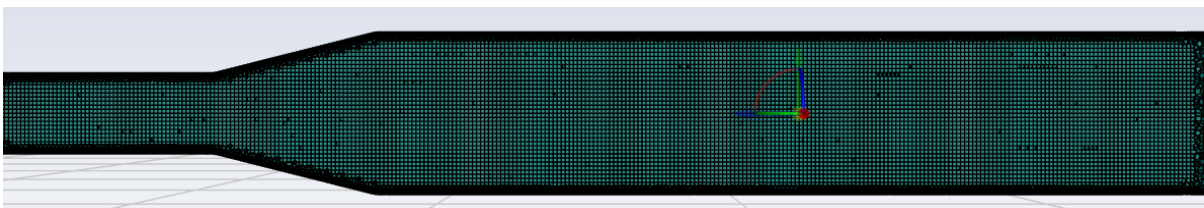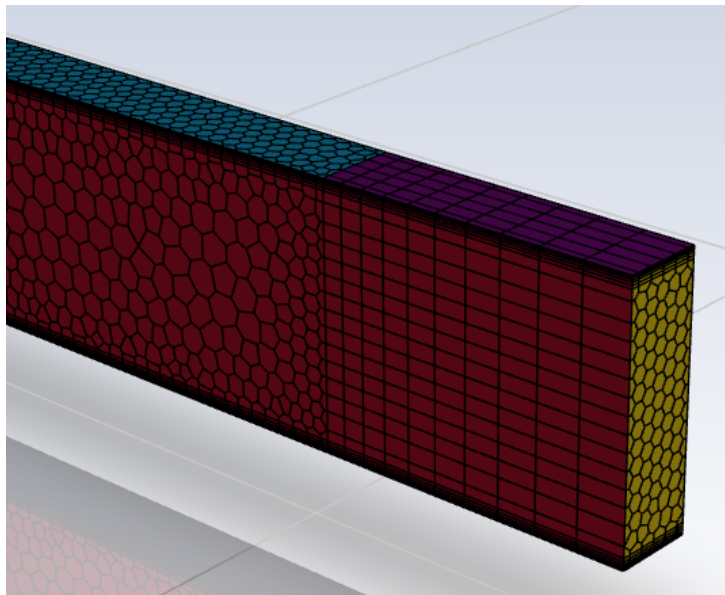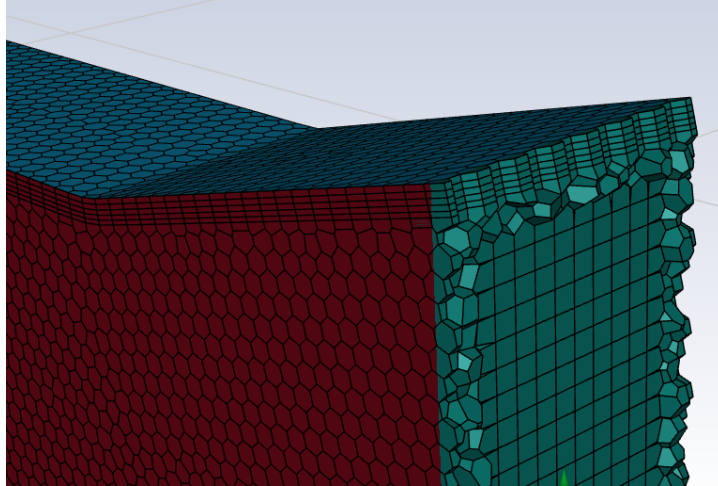
Name – Swadesh Suman
Mail – swadesh.suman@mail.mcgill.ca

Solution –

Flow parameters and boundary conditions –

- Fluid = water-liquid
- Inlet = 40 m/s flow velocity
- Viscous model = k-omega (SST)

Name – Swadesh Suman
Mail – swadesh.suman@mail.mcgill.ca

turbulence-energy_co
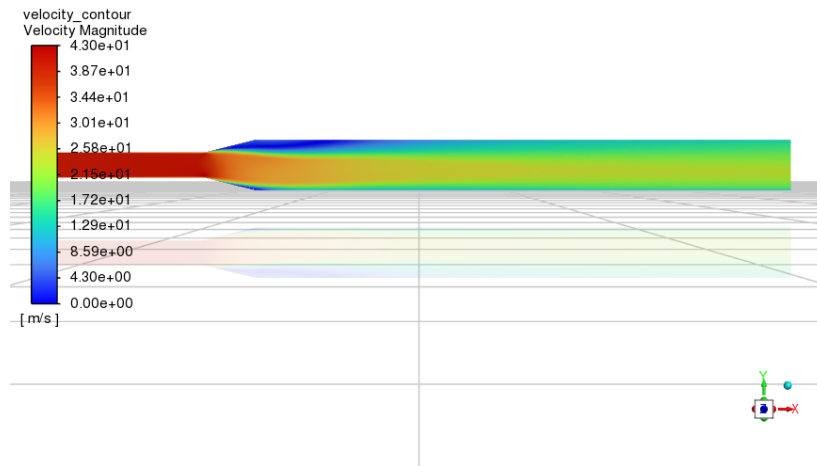Turbulent Kinetic Ener

4.08e+01	
3.67e+01	
3.26e+01	
2.85e+01	
2.45e+01	
2.04e+01	
1.63e+01	
1.22e+01	
8.16e+00	
4.08e+00	
2.98e-03	

[m^2/s^2]

— wall_lower
— wall_upper

The effect of imperfect inlet condition (constant velocity)

Reattachment

Wall Shear Stress [Pa]

3.50e+03
3.00e+03
2.50e+03
2.00e+03
1.50e+03
1.00e+03
5.00e+02
0.00e+00

0   200   400   600   800   1e+03   1.2e+03

Position [mm]

Separation

Name – Swadesh Suman
Mail – swadesh.suman@mail.mcgill.ca

Name – Swadesh Suman
Mail – swadesh.suman@mail.mcgill.ca