HW: Laminar flow(in a pipe)

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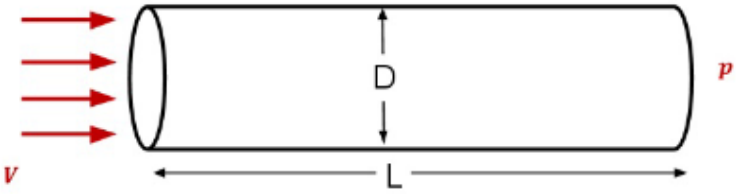
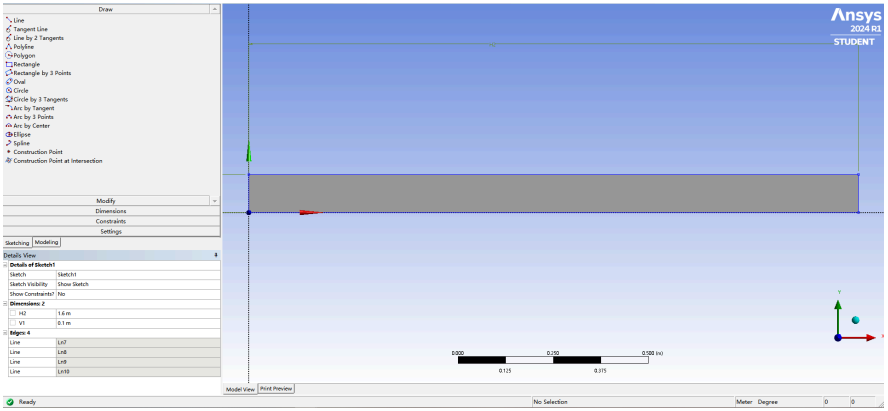
Content:

Problem



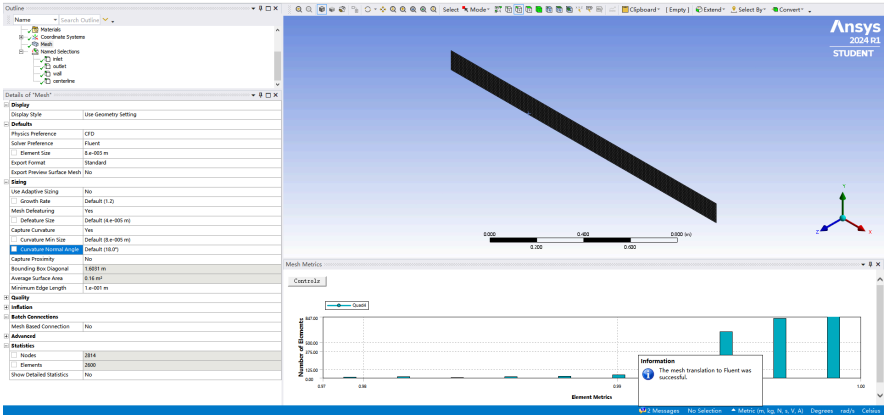
Computational domain

Geometric dimensions: 1.6m * 0.2m (2d symmetry)



Mesh and its parameters

Element size: 8e-3 m Mesh total: 2814

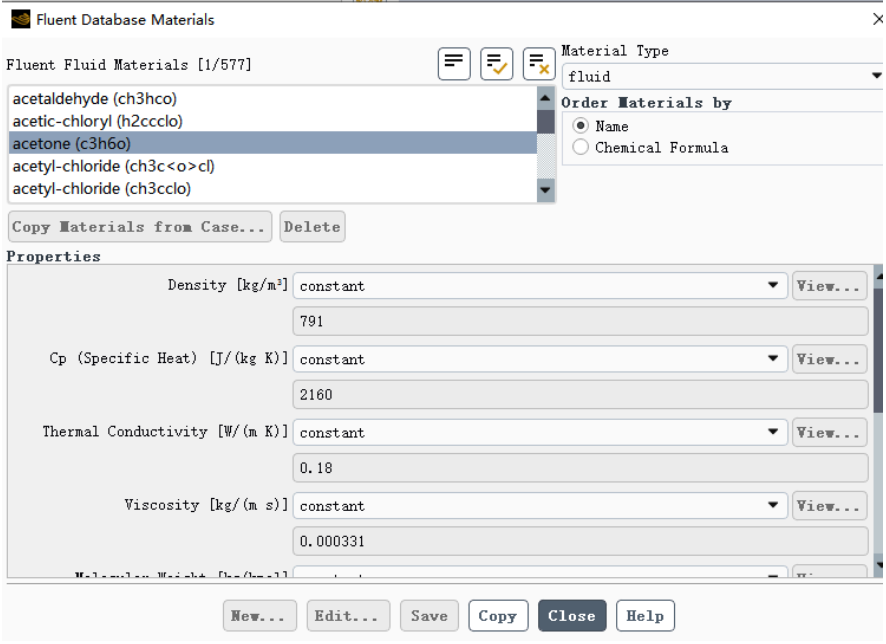


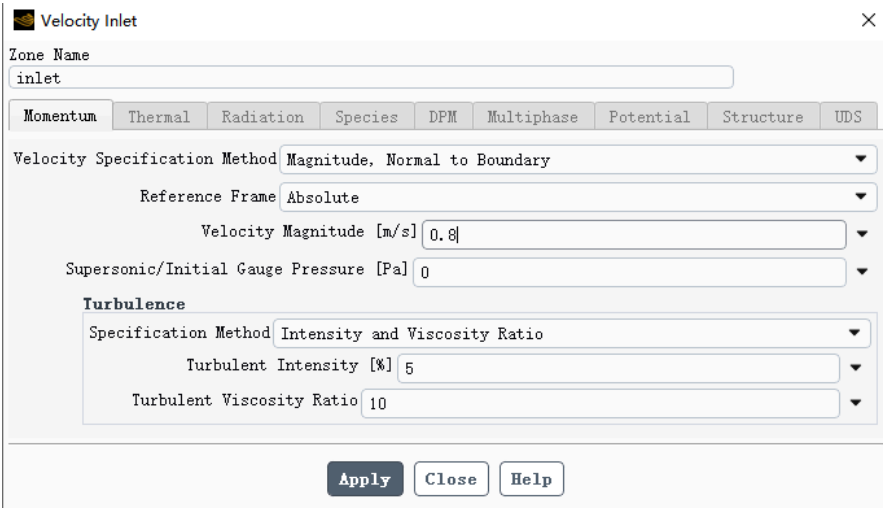
Model setup and boundary conditions from Fluent

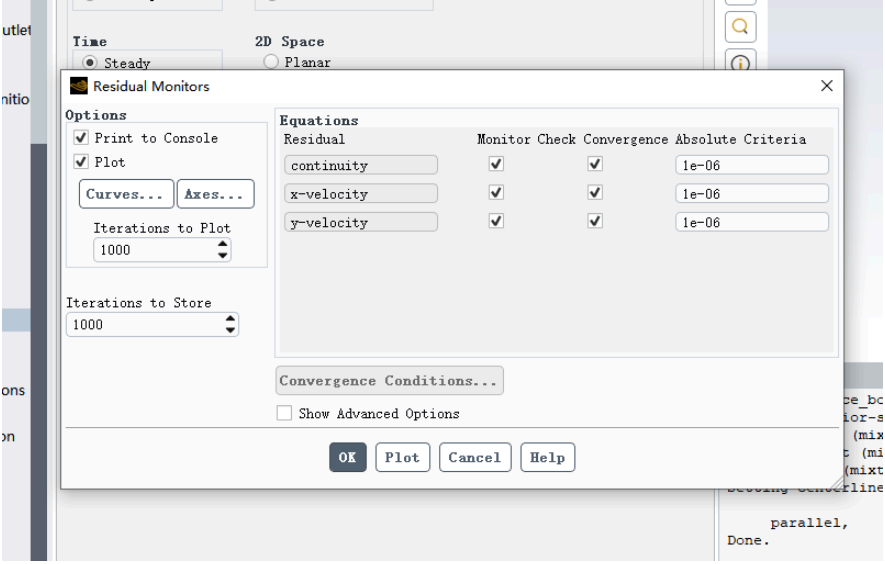
- double precision
- fluid: acetone , $\rho = 791\ kg/m^3, \nu = 0.000331\ kg/m \cdot s$,

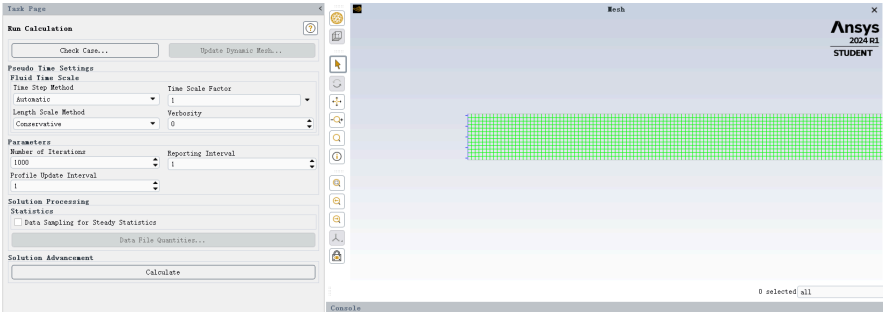
$$Re = \frac{\rho v d}{\mu}$$

- Velocity of fluid from inlet: 0.7 m/s. We can get Re of acetone in the pipe with diameter of $0.2m$,
- $$Re = 451.62$$
- model: laminar flow. The flow of liquid is relatively simple in this task, so we only use the laminar model
- Residuals: all set to 1e-6
- Num of iterations: 1000

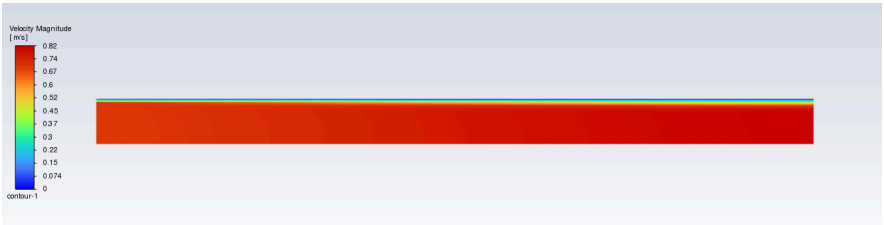

Fluent Database Materials
Fluent Fluid Materials [1/577]
acetaldehyde (ch3hco)
acetic-chloryl (h2ccclo)
acetone (c3h6o)
acetyl-chloride (ch3c<o>cl)
acetyl-chloride (ch3cclo)
Material Type
fluid
Order Materials by
Name
Chemical Formula
Copy Materials from Case...
Delete
Properties
Density [kg/m³]
constant
View...
791
Cp (Specific Heat) [J/(kg K)]
constant
View...
2160
Thermal Conductivity [W/(m K)]
constant
View...
0.18
Viscosity [kg/(m s)]
constant
View...
0.000331
New...
Edit...
Save
Copy
Close
Help

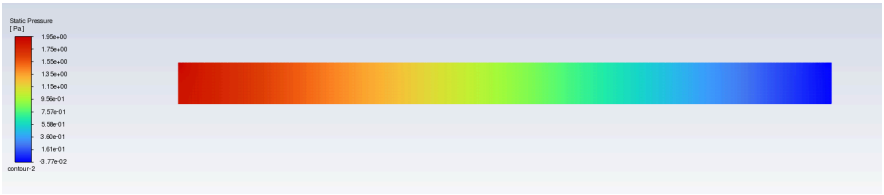

Velocity Inlet
Zone Name
inlet
Momentum
Thermal
Radiation
Species
DPM
Multiphase
Potential
Structure
UDS
Velocity Specification Method
Magnitude, Normal to Boundary
Reference Frame
Absolute
Velocity Magnitude [m/s]
0.8
Supersonic/Initial Gauge Pressure [Pa]
0
Turbulence
Specification Method
Intensity and Viscosity Ratio
Turbulent Intensity [%]
5
Turbulent Viscosity Ratio
10
Apply
Close
Help





distribution of velocity and pressure





Questions:

The transition area of laminar flow in the image is not as smooth as in the tutorial. I tried to use different material and reduce the residuals, still it didn't get smooother. Here I present the velocity and pressure along y-aixs(in the middle of the pipe), the distribution is not smooth either.