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Complex Engineering Problem (CEP)

Fluid Mechanics-II

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Roll Number: FA20-BME-076

Section: B

Session:2020-2024

Statement:

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Design and simulate the circular pipe for analysis of standard water in different flow region.

Given Data:

L=1.2

D=10mm

Re=9100-1000

Tout=?

Solution:

We take three Reynolds number between 9100 &1000 they are 9100,9300&9800.

SOLIDWORKS Flow Simulation Project Report

April 7, 2023

Table of Contents

1 General Information

Objective of the simulation

1.1 Analysis Environment

Software Product:	Flow Simulation 2019 SP5.0. Build: 4725
CPU Type:	Intel(R) Core(TM) i5-6300U CPU @ 2.40GHz
CPU Speed:	2496 (2396) MHz
RAM:	8072 MB / 134217727 MB
Operating System:	Windows 10 (or higher) (Version 10.0.19045)

1.2 Model Information

Model Name:	noman group assignment.SLDPRT
Project Name:	Project(1)

1.3 Project Comments:

Unit System:	SI (m-kg-s)
Analysis Type:	Internal

1.4 Size of Computational Domain

Size

X min	-0.005 m
X max	0.005 m
Y min	-0.005 m
Y max	0.005 m
Z min	0.004 m
Z max	0.996 m
X size	0.010 m
Y size	0.010 m
Z size	0.992 m

1.5 Simulation Parameters

1.5.1 Mesh Settings

1.5.1.1 Basic Mesh

Basic Mesh Dimensions

Number of cells in X	2
Number of cells in Y	2
Number of cells in Z	214

1.5.1.2 Analysis Mesh

Total Cell count: 39376

Fluid Cells: 39376

Solid Cells: 27432

Partial Cells: 24008

Trimmed Cells: 0

1.5.1.3 Additional Physical Calculation Options

Heat Transfer Analysis: Heat conduction in solids: Off

Flow Type: Turbulent only

Time-Dependent Analysis: Off

Gravity: Off

Radiation:

Humidity:

Default Wall Roughness: 0 micrometer

1.5.2 Material Settings

Material Settings

Fluids

Air

Water

1.5.3 Initial Conditions

Initial Conditions

Thermodynamic parameters	Static Pressure: 101325.00 Pa Temperature: 303.00 K
Velocity parameters	Velocity vector Velocity in X direction: 0 m/s Velocity in Y direction: 0 m/s Velocity in Z direction: 0 m/s

1.5.4 Boundary Conditions

Boundary Conditions

Inlet Velocity 1

Type	Inlet Velocity
Faces	
Coordinate system	Global coordinate system
Reference axis	X
Flow parameters	Flow vectors direction: Normal to face Velocity normal to face: 0.080 m/s Fully developed flow: No
Thermodynamic parameters	Temperature type: Temperature of initial components Temperature: 303.00 K
Boundary layer parameters	Boundary layer type: Turbulent

Environment Pressure 1

Type	Environment Pressure
Faces	
Coordinate system	Global coordinate system
Reference axis	X
Thermodynamic parameters	Environment pressure: 101325.00 Pa Temperature type: Temperature of initial components

	Temperature: 303.00 K

1.5.5 Volumetric Heat Sources

1.5.6 Engineering Goals

Goals

Global Goals

GG Maximum Temperature (Fluid) 1

Type	Global Goal
Goal type	Temperature (Fluid)
Calculate	Maximum value
Coordinate system	Global coordinate system
Use in convergence	On

1.6 Analysis Time

Calculation Time: 163 s

Number of Iterations: 139

Warnings:

2 Results

2.1 Analysis Goals

Goals

Name	Unit	Value	Progress	Criteria	Delta	Use in convergence
GG Maximum Temperature (Fluid) 1	K	325.61	100	0.267627247	0.266972892	On

2.2 Global Min-Max-Table

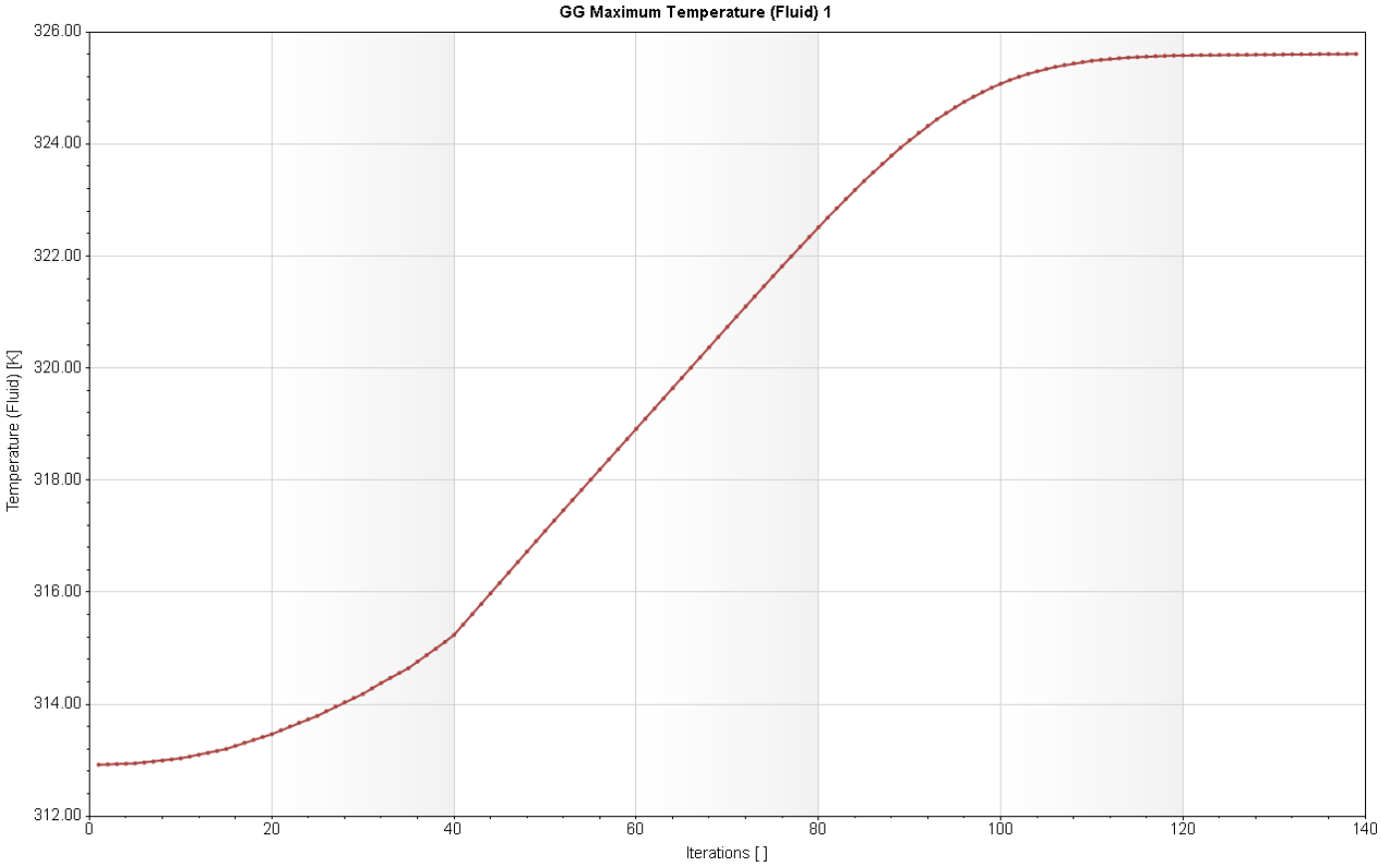
Min/Max Table

Name	Minimum	Maximum
Density (Fluid) [kg/m^3]	990.03	994.85
Pressure [Pa]	101325.00	101345.91
Temperature [K]	303.00	325.61
Temperature (Fluid) [K]	303.00	325.61
Velocity [m/s]	0	0.101
Velocity (X) [m/s]	-0.001	0.001
Velocity (Y) [m/s]	-0.001	0.001
Velocity (Z) [m/s]	0	0.101
Velocity RRF [m/s]	0	0.101
Velocity RRF (X) [m/s]	-0.001	0.001
Velocity RRF (Y) [m/s]	-0.001	0.001
Velocity RRF (Z) [m/s]	0	0.101
Vorticity [1/s]	0.04	39.96
Relative Pressure [Pa]	-1.24e-03	20.91
Shear Stress [Pa]	0.05	0.19
Bottleneck Number [ ]	1.4886189e-08	1.0000000

Heat Transfer Coefficient [W/m^2/K]	442.493	6661.332
ShortCut Number [ ]	6.2429913e-10	1.0000000
Surface Heat Flux [W/m^2]	10000.000	10000.000
Surface Heat Flux (Convective) [W/m^2]	-1.265e+08	1.017e+08
Acoustic Power [W/m^3]	0	2.385e-26
Acoustic Power Level [dB]	0	0

2.3 Results

2.4 Conclusion



3 Appendix

3.1 Material Data

Engineering Database

Gases

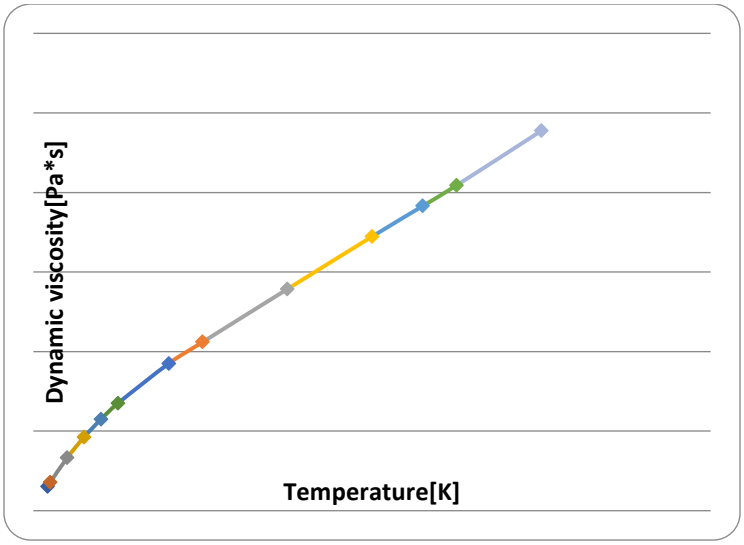
Air

Path: Gases Pre-Defined

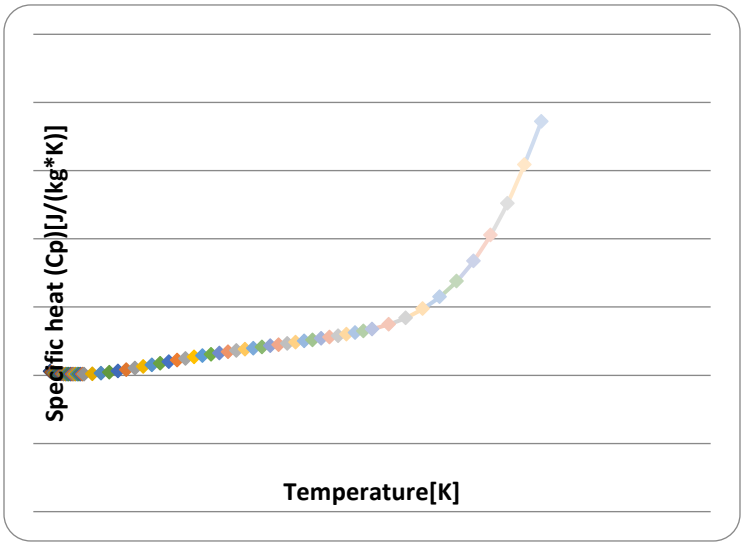
Specific heat ratio (Cp/Cv): 1.399

Molecular mass: 0.0290 kg/mol

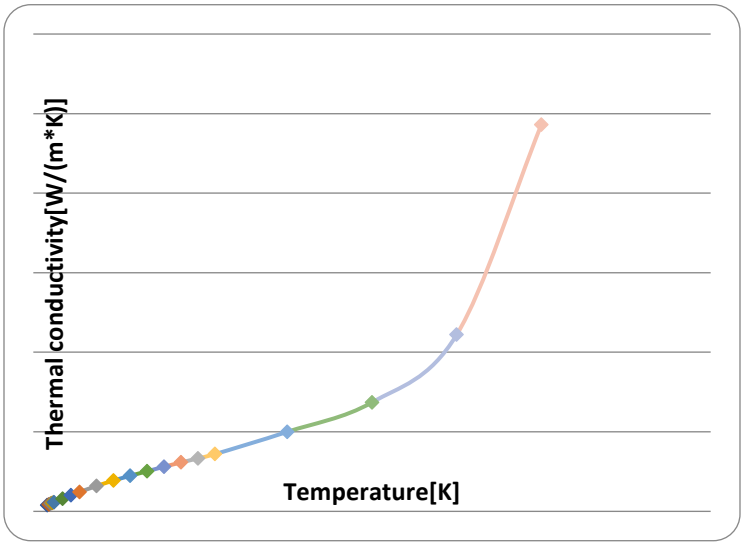
Dynamic viscosity



Specific heat (Cp)



Thermal conductivity

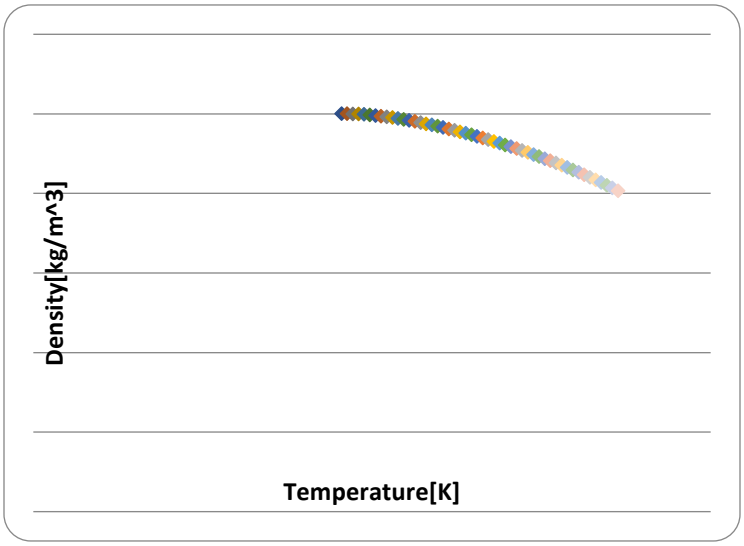


Liquids

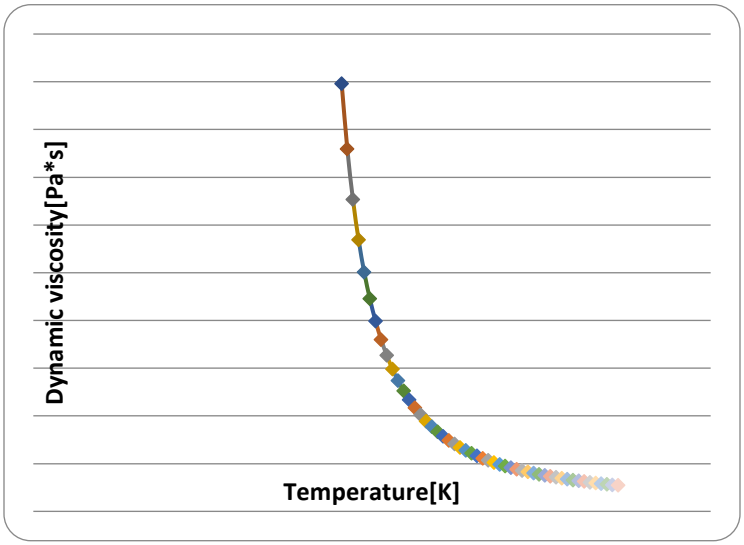
Water

Path: Liquids Pre-Defined

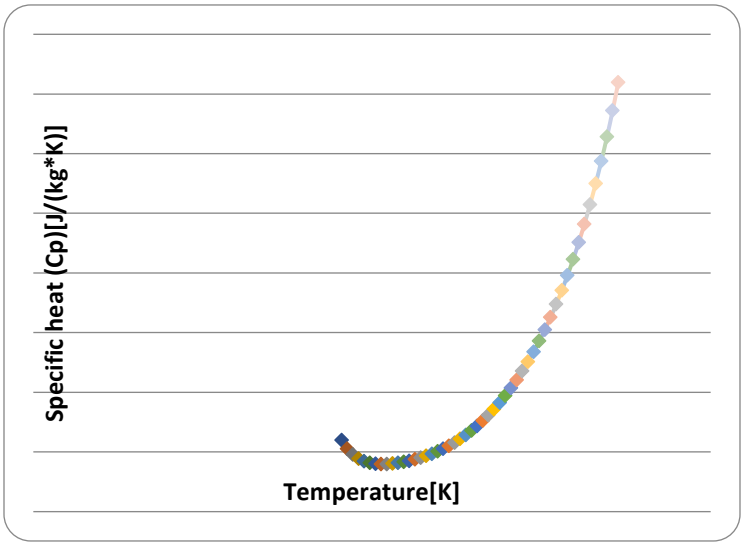
Density



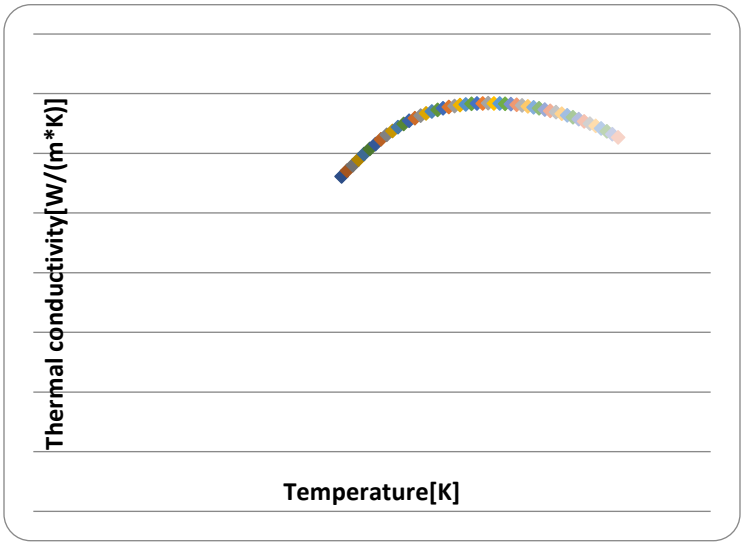
Dynamic viscosity



Specific heat (Cp)



Thermal conductivity

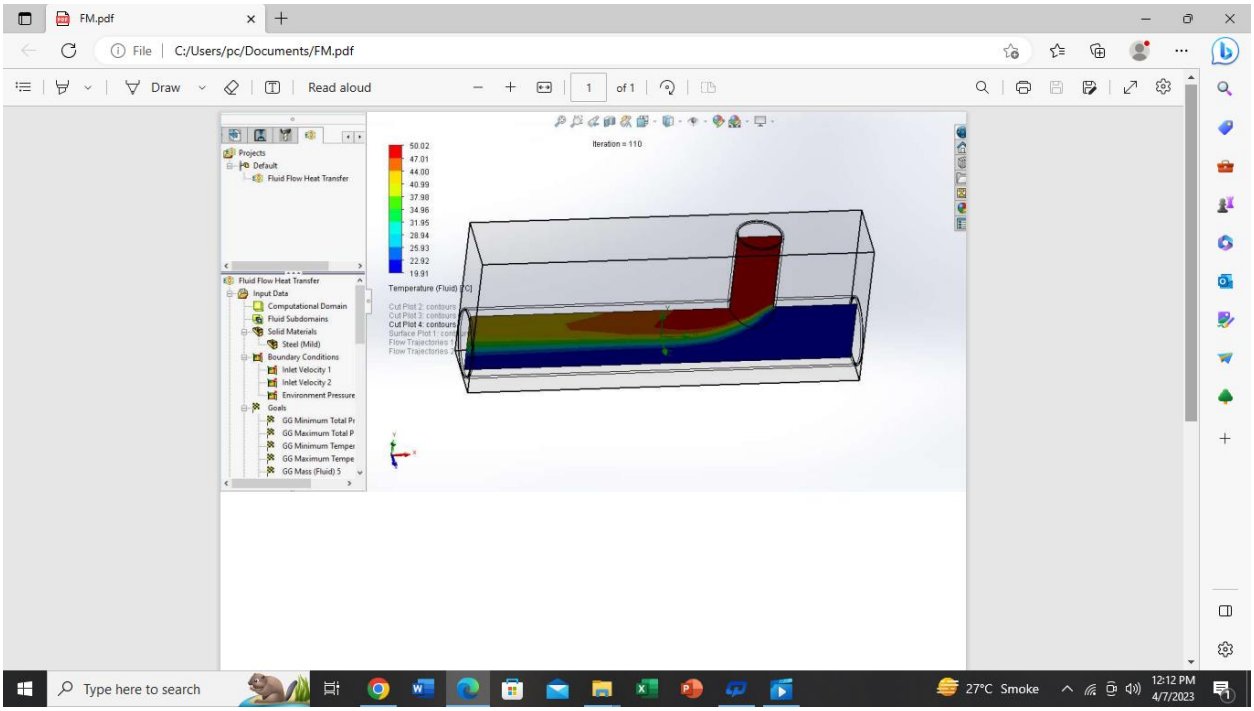


Cavitation effect: Yes

Temperature: 0 K

Saturation pressure: 0 Pa

Radiation properties: No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File | C:/Users/pc/Documents/FM.pdf
Draw
Read aloud
1
of 1
Iteration = 110
50.02
47.01
44.00
40.99
37.98
34.96
31.95
28.94
25.93
22.92
19.91
Temperature (Fluid) (°C)
Projects
Default
Fluid Flow Heat Transfer
Input Data
Computational Domain
Fluid Subdomains
Solid Materials
Steel (Mild)
Boundary Conditions
Inlet Velocity 1
Inlet Velocity 2
Environment Pressure
Goals
Type here to search
27°C Smoke
12:12 PM
4/7/2023