Ansys 2022 R2

Ansys Fluent Simulation Report

Table of Contents

Geometry and Mesh

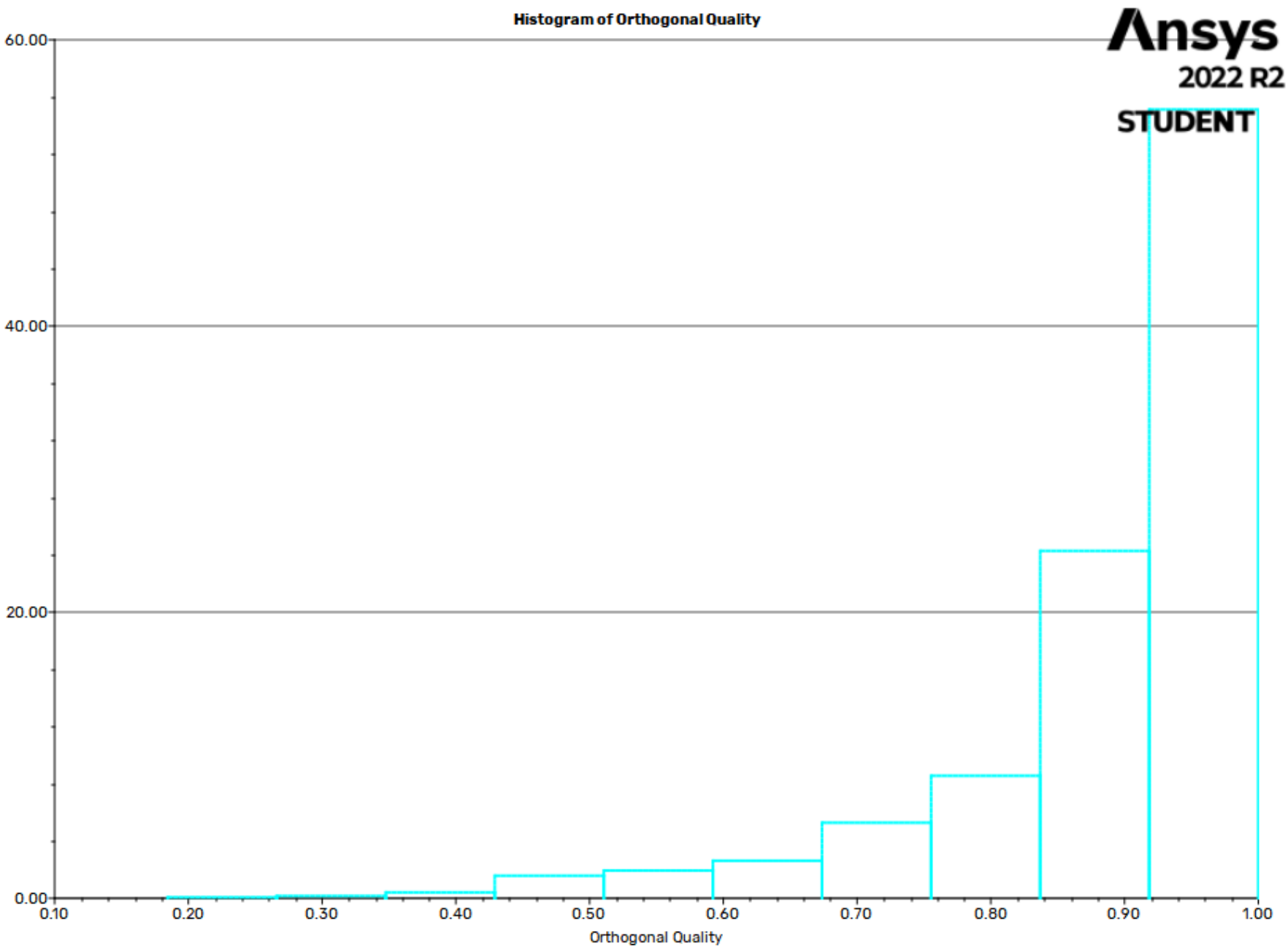
Mesh Size

Cells	Faces	Nodes
340511	1722491	1139589

Mesh Quality

Name	Type	Min Orthogonal Quality	Max Aspect Ratio
fluid:0	Mixed Cell	0.18443287	37.139968
solid_heatsink	Poly Cell	0.20245364	9.7995627
solid_heatsource	Poly Cell	0.60965916	4.9581703
solid_board	Poly Cell	0.19757284	31.509989

Orthogonal Quality



Simulation Setup

Physics

Models

Model	Settings
Space	3D
Time	Steady
Viscous	Laminar
Heat Transfer	Enabled
Radiation	Surface to Surface

Material Properties

− Fluid	
− air	
Density	incompressible ideal gas
Cp (Specific Heat)	1006.43 J/(kg K)
Thermal Conductivity	0.0242 W/(m K)
Viscosity	1.7894e-05 kg/(m s)

Molecular Weight	28.966 kg/kmol
− Solid	
− component	
Density	1900 kg/m^3
Cp (Specific Heat)	795 J/(kg K)
Thermal Conductivity	10 W/(m K)
− fr-4	
Density	1250 kg/m^3
Cp (Specific Heat)	1300 J/(kg K)
Thermal Conductivity	0.35 W/(m K)
− copper	
Density	8978 kg/m^3
Cp (Specific Heat)	381 J/(kg K)
Thermal Conductivity	387.6 W/(m K)
− aluminum	
Density	2719 kg/m^3
Cp (Specific Heat)	871 J/(kg K)
Thermal Conductivity	202.4 W/(m K)

Cell Zone Conditions

− Fluid	
− fluid:0	
Material Name	air
Specify source terms?	no
Specify fixed values?	no
Frame Motion?	no
Porous zone?	no
3D Fan Zone?	no
− Solid	
− solid_heatsink	
Material Name	copper
Specify source terms?	no
Specify fixed values?	no
Frame Motion?	no
Solid Motion?	no
− solid_heatsource	
Material Name	component
Specify source terms?	yes
− Source Terms	
energy	75[W]/Volume(['solid_heatsource'])
Specify fixed values?	no
Frame Motion?	no
Solid Motion?	no
− solid_board	
Material Name	fr 4

Specify source terms?	no
Specify fixed values?	no
Frame Motion?	no
Solid Motion?	no

Boundary Conditions

− Inlet	
− pressure_in	
Reference Frame	Absolute
Gauge Total Pressure [Pa]	0
Supersonic/Initial Gauge Pressure [Pa]	0
Total Temperature [C]	45
Direction Specification Method	Normal to Boundary
Build artificial walls to prevent reverse flow?	no
External Black Body Temperature Method	Boundary Temperature
Internal Emissivity	1
Participates in View Factor Calculation?	yes
− Outlet	
− pres_outlet	
Backflow Reference Frame	Absolute
Gauge Pressure [Pa]	0
Pressure Profile Multiplier	1
Backflow Total Temperature [C]	45
Backflow Direction Specification Method	Normal to Boundary
External Black Body Temperature Method	Boundary Temperature
Internal Emissivity	1
Backflow Pressure Specification	Total Pressure
Build artificial walls to prevent reverse flow?	no
Radial Equilibrium Pressure Distribution	no
Average Pressure Specification?	no
Specify targeted mass flow rate	no
Participates in View Factor Calculation?	yes
− Wall	
− wall_heatsink	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Coupled
Enable shell conduction?	no
Wall Motion	Stationary Wall
Shear Boundary Condition	No Slip
Internal Emissivity	0.9
Radiation BC Type	Opaque
Participates in View Factor Calculation?	yes
Faces Per Surface Cluster	1

Convective Augmentation Factor	1
▬ wall_heatsink-wall_heatsource-solid_heatsink-solid_heatsource	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Coupled
Enable shell conduction?	no
Radiation BC Type	Opaque
Convective Augmentation Factor	1
▬ wall_board_1	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Heat Flux
Heat Flux [W/m^2]	0
Enable shell conduction?	no
Radiation BC Type	Opaque
Convective Augmentation Factor	1
▬ wall_board-wall_heatsource-solid_board-solid_heatsource	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Coupled
Enable shell conduction?	no
Radiation BC Type	Opaque
Convective Augmentation Factor	1
▬ wall_heatsource	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Coupled
Enable shell conduction?	no
Wall Motion	Stationary Wall
Shear Boundary Condition	No Slip
Internal Emissivity	0.3
Radiation BC Type	Opaque
Participates in View Factor Calculation?	yes
Faces Per Surface Cluster	1
Convective Augmentation Factor	1
▬ in-1	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Heat Flux
Heat Flux [W/m^2]	0

Enable shell conduction?	no
Radiation BC Type	Opaque
Convective Augmentation Factor	1
━ out-1	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Heat Flux
Heat Flux [W/m^2]	0
Enable shell conduction?	no
Radiation BC Type	Opaque
Convective Augmentation Factor	1
━ wall_board	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Coupled
Enable shell conduction?	no
Wall Motion	Stationary Wall
Shear Boundary Condition	No Slip
Internal Emissivity	0.9
Radiation BC Type	Opaque
Participates in View Factor Calculation?	yes
Faces Per Surface Cluster	1
Convective Augmentation Factor	1
━ wall_outer	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Heat Flux
Heat Flux [W/m^2]	0
Enable shell conduction?	no
Wall Motion	Stationary Wall
Shear Boundary Condition	No Slip
Internal Emissivity	0.9
Radiation BC Type	Opaque
Participates in View Factor Calculation?	yes
Faces Per Surface Cluster	1
Convective Augmentation Factor	1
━ wall_heatsink-shadow	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Coupled
Enable shell conduction?	no

Radiation BC Type	Opaque
Convective Augmentation Factor	1
− wall_heatsink-wall_heatsource-solid_heatsink-solid_heatsource-shadow	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Coupled
Enable shell conduction?	no
Radiation BC Type	Opaque
Convective Augmentation Factor	1
− wall_board-wall_heatsource-solid_board-solid_heatsource-shadow	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Coupled
Enable shell conduction?	no
Radiation BC Type	Opaque
Convective Augmentation Factor	1
− wall_heatsource-shadow	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Coupled
Enable shell conduction?	no
Radiation BC Type	Opaque
Convective Augmentation Factor	1
− wall_board-shadow	
Wall Thickness [m]	0
Heat Generation Rate [W/m^3]	0
Material Name	aluminum
Thermal BC Type	Coupled
Enable shell conduction?	no
Radiation BC Type	Opaque
Convective Augmentation Factor	1

Reference Values

Area	1 m^2
Density	1.225 kg/m^3
Enthalpy	0 J/kg
Length	1 m
Pressure	0 Pa
Temperature	288.16 C
Velocity	1 m/s
Viscosity	1.7894e-05 kg/(m s)

Ratio of Specific Heats	1.4
Yplus for Heat Tran. Coef.	300
Reference Zone	fluid:0

Solver Settings

— Equations	
Flow	True
Energy	True
— Numerics	
Absolute Velocity Formulation	True
— Pseudo Time Explicit Relaxation Factors	
Density	1
Body Forces	1
Energy	0.75
Explicit Momentum	0.5
Explicit Pressure	0.5
— Pressure-Velocity Coupling	
Type	Coupled
Pseudo Time Method (Global Time Step)	True
— Discretization Scheme	
Pressure	Body Force Weighted
Momentum	Second Order Upwind
Energy	Second Order Upwind
— Solution Limits	
Minimum Absolute Pressure [Pa]	1
Maximum Absolute Pressure [Pa]	5e+10
Minimum Temperature [C]	1
Maximum Temperature [C]	5000

Run Information

Number of Machines	1
Number of Cores	2
Case Read	11.568 seconds
Data Read	4.934 seconds
Iteration	345.481 seconds
AMG	251.863 seconds
Virtual Current Memory	2.58194 GB
Virtual Peak Memory	3.26065 GB
Memory Per M Cell	6.63817

Solution Status

Iterations: 248

	Value	Absolute Criteria	Convergence Status
continuity	8.231772e-07	0.001	Converged
x-velocity	2.108387e-07	0.001	Converged
y-velocity	2.969673e-06	0.001	Converged
z-velocity	2.441956e-07	0.001	Converged
energy	8.02623e-10	1e-09	Converged

Named Expressions

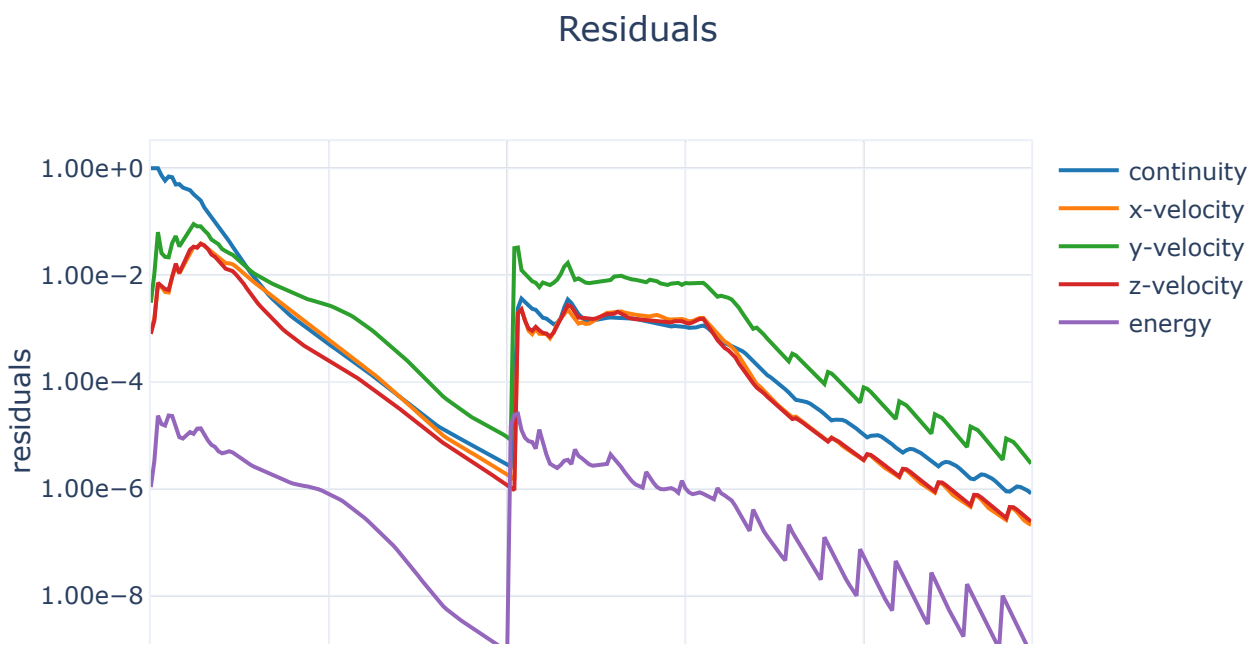
Expression	Definition	Value	Unit	Used In	Description
parameter_1		Unable to evaluate			
parameter_2	75 [W]/Volume(['solid_heatsource'])	635162.6	[kg m^-1 s^-3]		

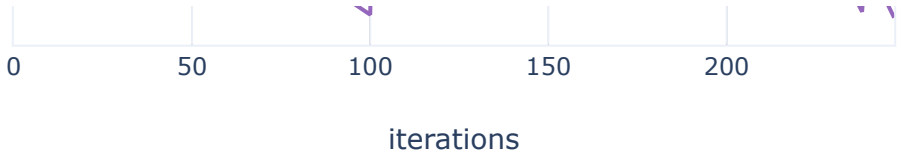
Report Definitions

report-def-0	0.0001111814	Pa
report-def-1	94.49674	C

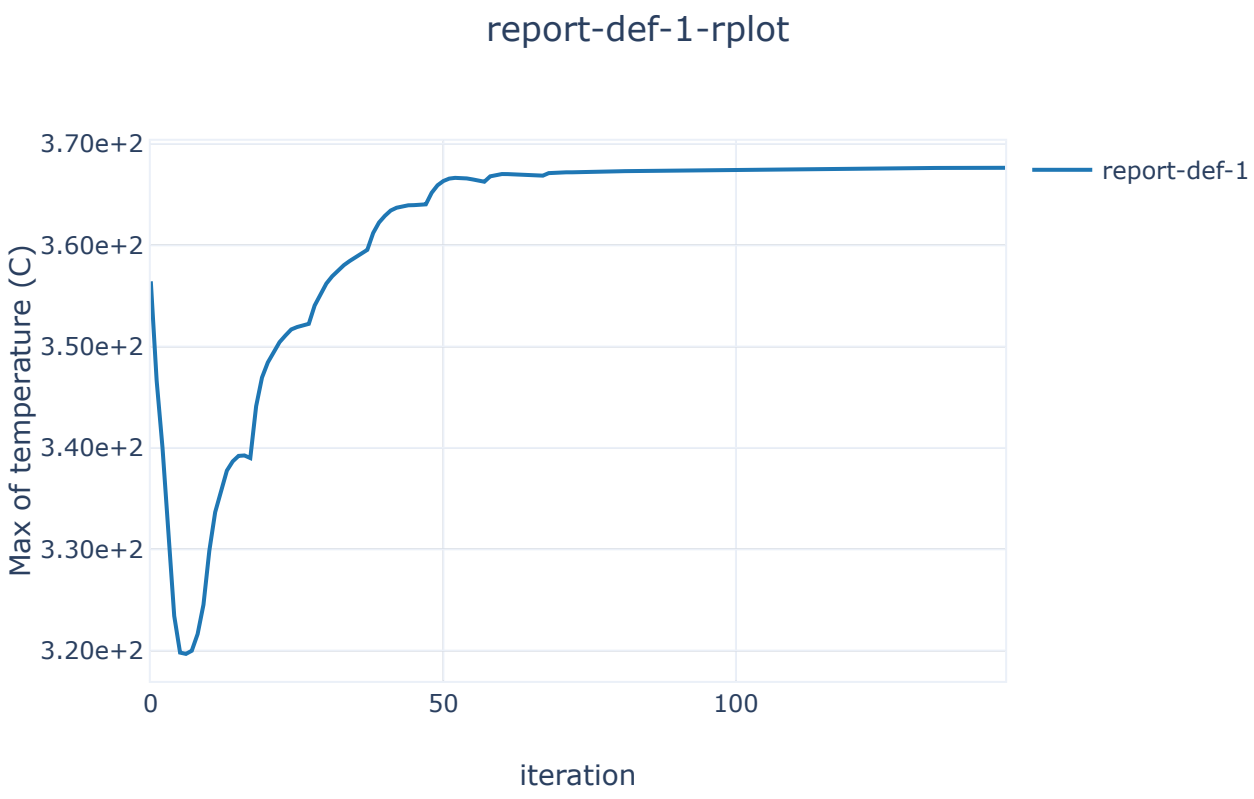
Plots

Residuals

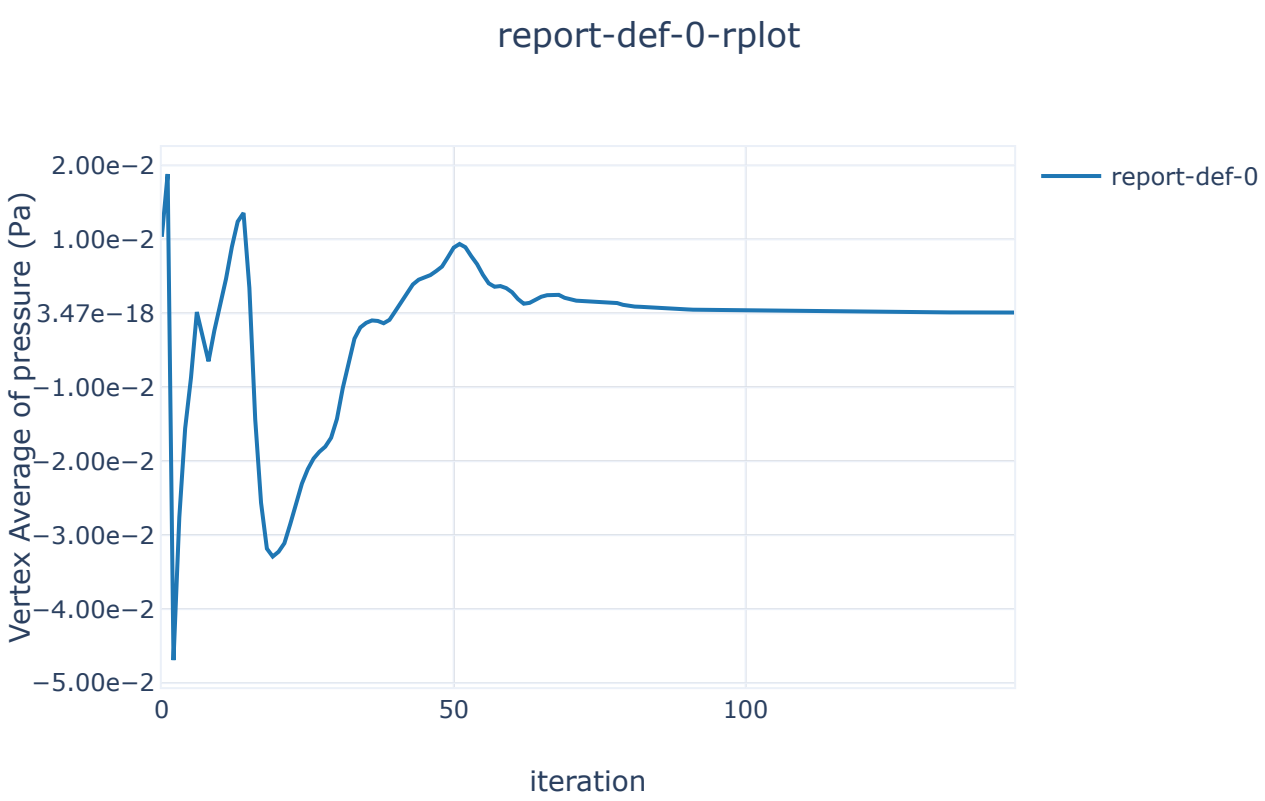




report-def-1-rplot

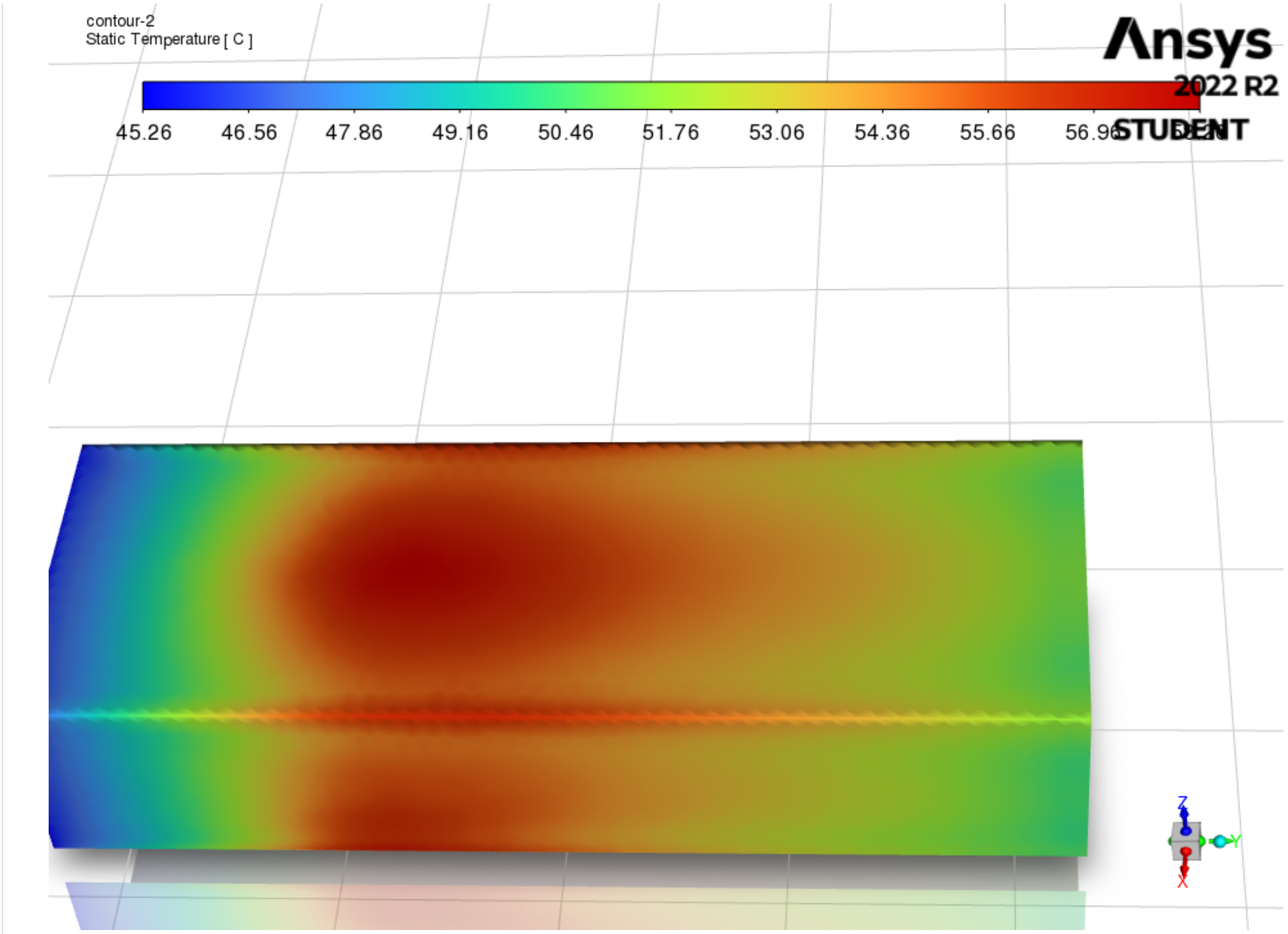


report-def-0-rplot



Contours

contour-2


contour-2
Static Temperature [C]
45.26
46.56
47.86
49.16
50.46
51.76
53.06
54.36
55.66
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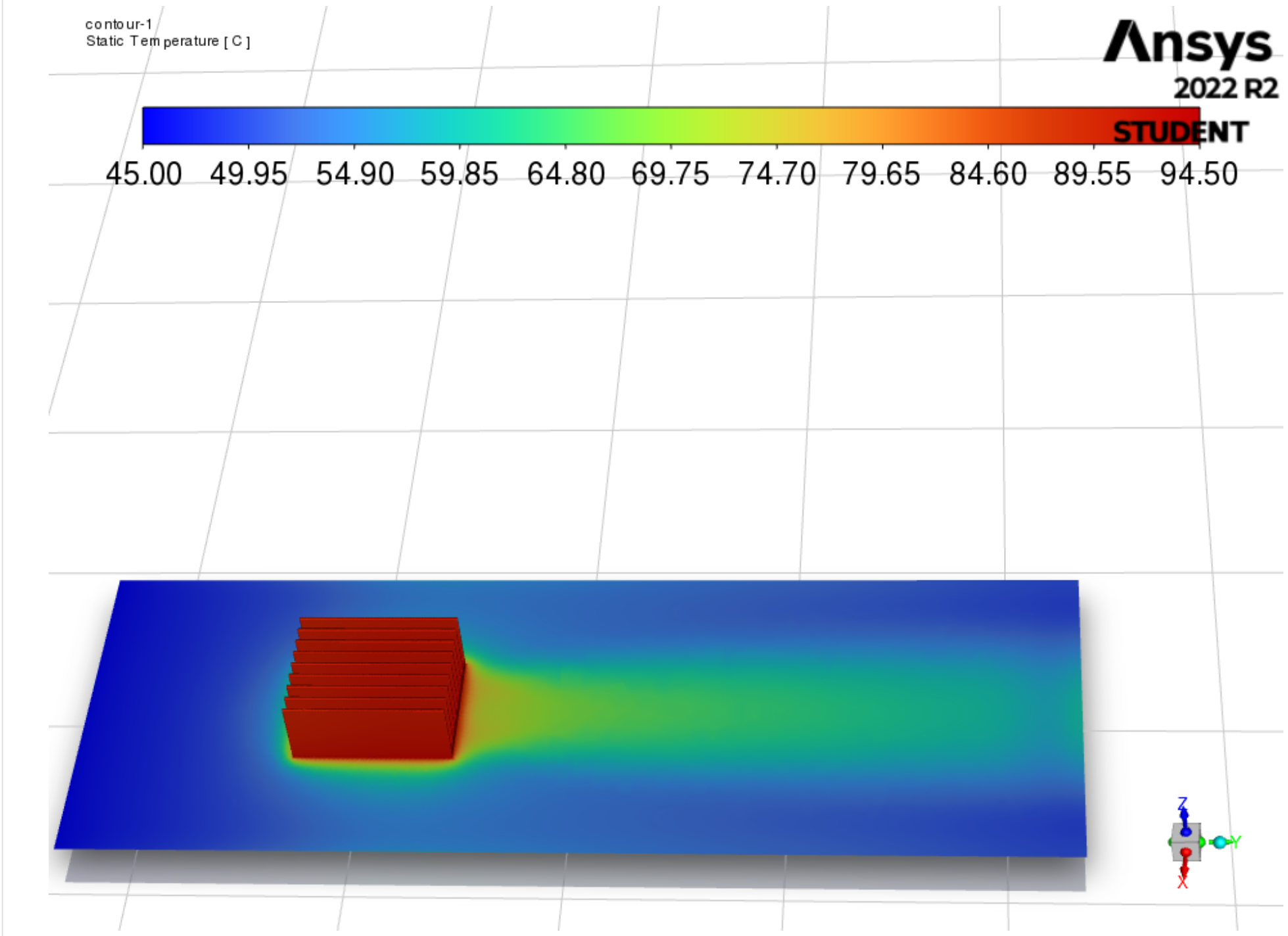
Z
Y
X

contour-1


contour-1
Static Temperature [C]
45.00
49.95
54.90
59.85
64.80
69.75
74.70
79.65
84.60
89.55
94.50
Ansys
2022 R2
STUDENT
Z
Y
X

XY Plots

xy-plot-1