PROJECT 2

MECH – 6627

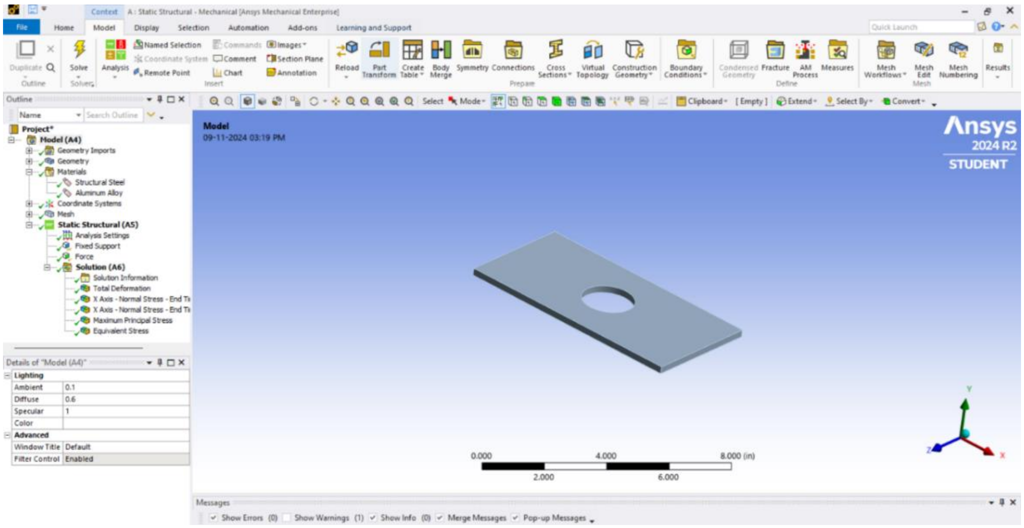
Computer Aided Engineering

Professor – George Bauer

By

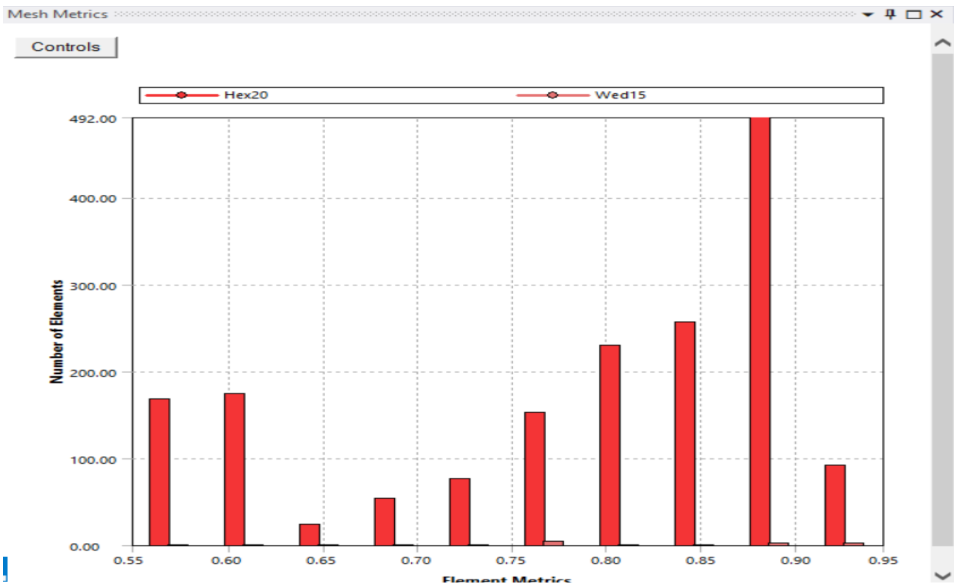
Yashwanth Kanthala (00921675)

TASK1: EXAMPLE 1

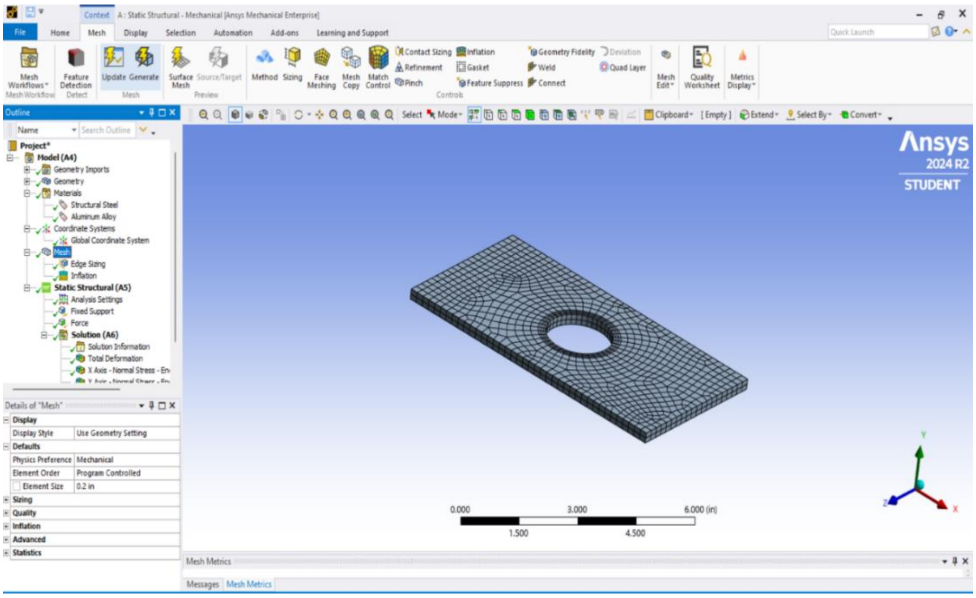


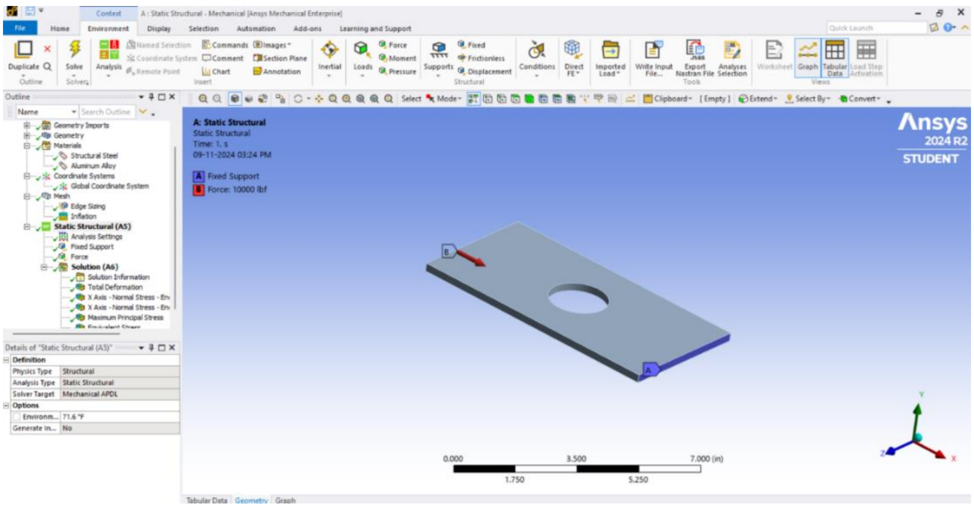
Outline of All Parameters

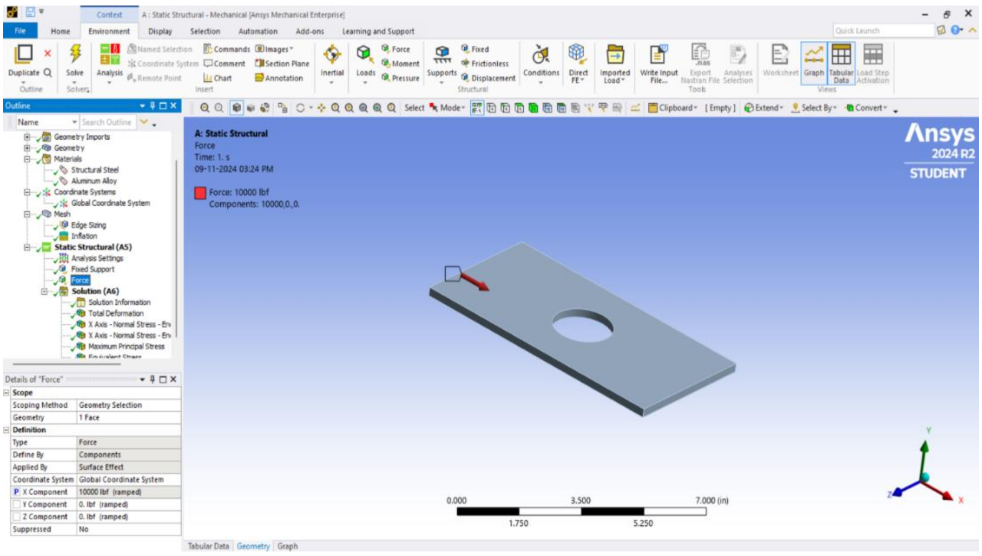
	A	B	C	D
1	ID	Parameter Name	Value	Unit
2	Input Parameters			
3	Static Structural (A1)			
4	P1	radius	0.875	in
5	P2	thickness	0.25	in
6	P3	plate width	2	in
7	P4	plate length	4	in
8	P7	Force X Component	10000	lbf
*	New input parameter	New name	New expression	
10	Output Parameters			
18	Charts			

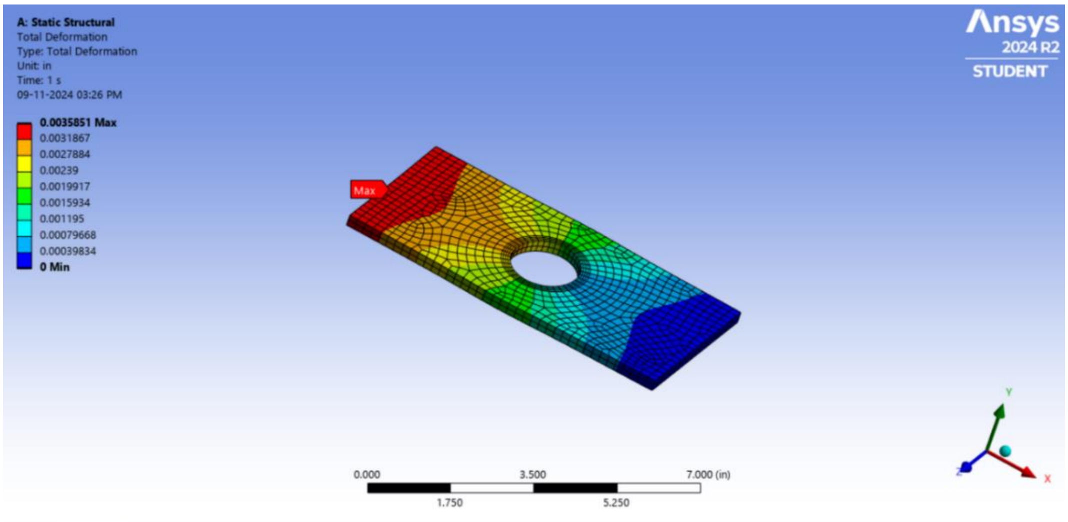


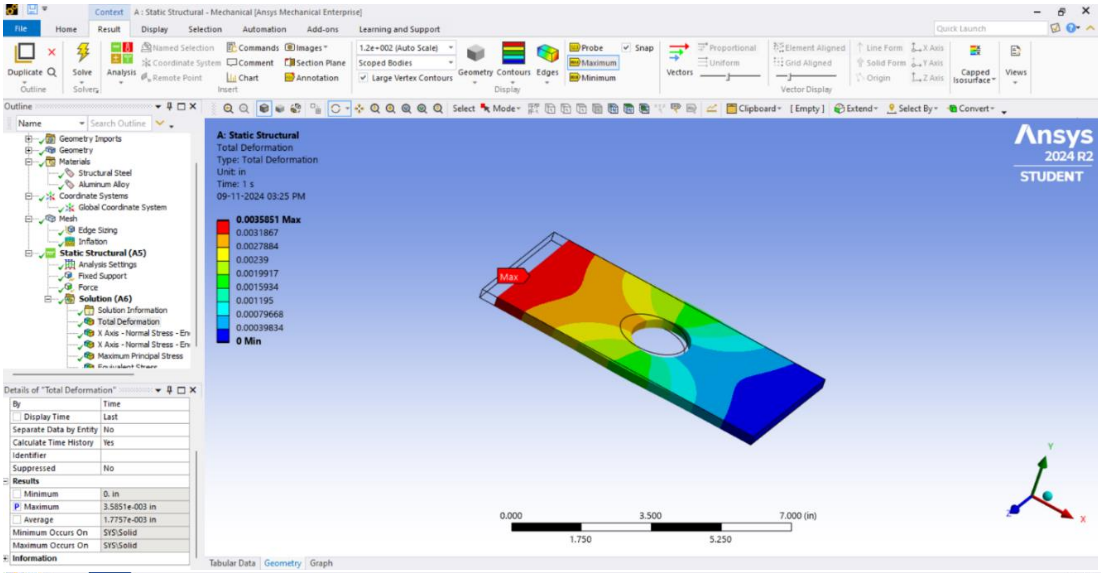
MESHING

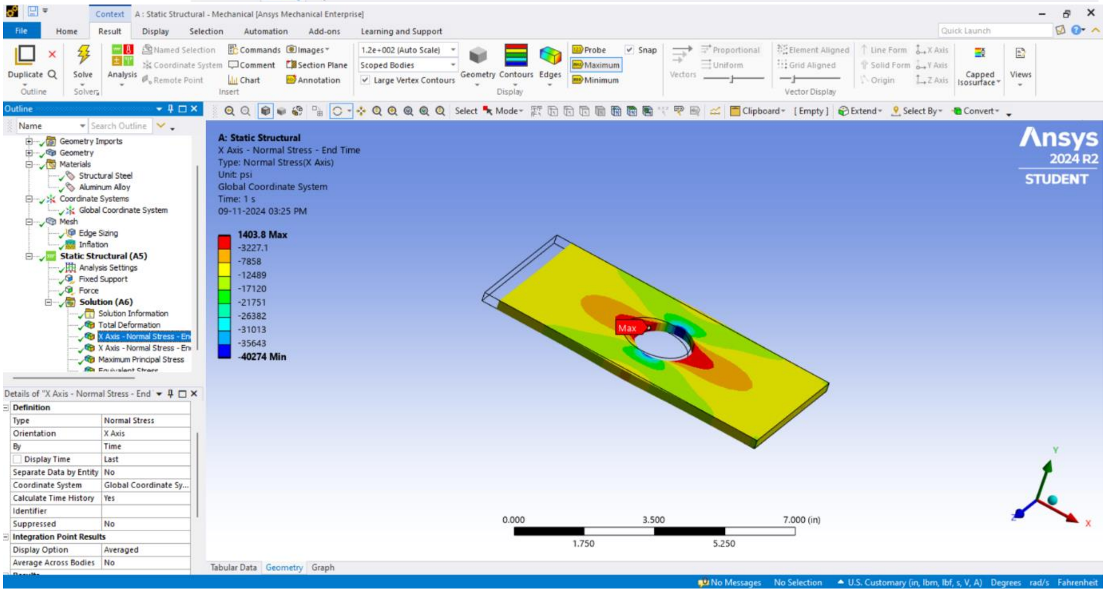


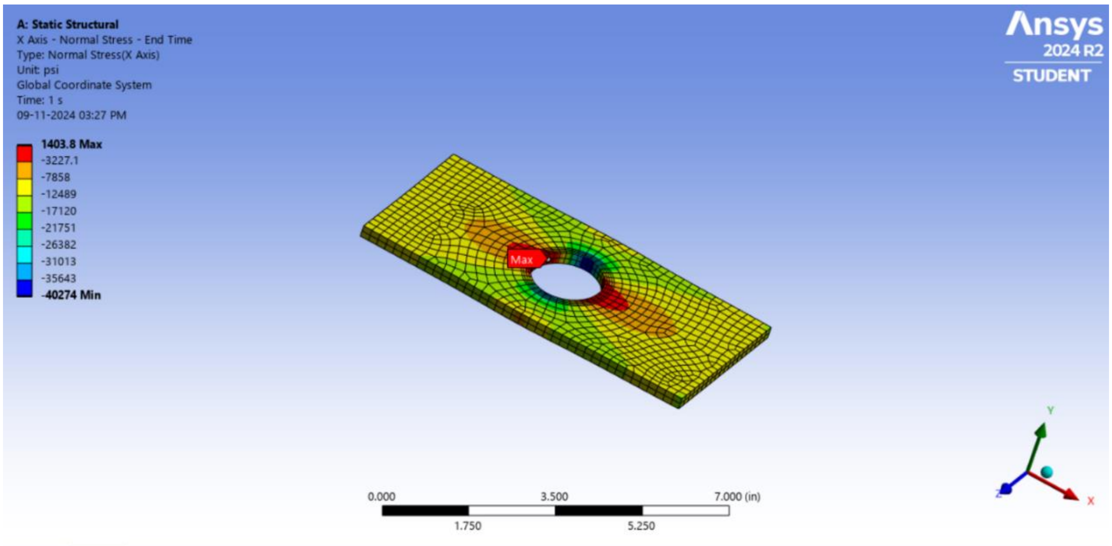


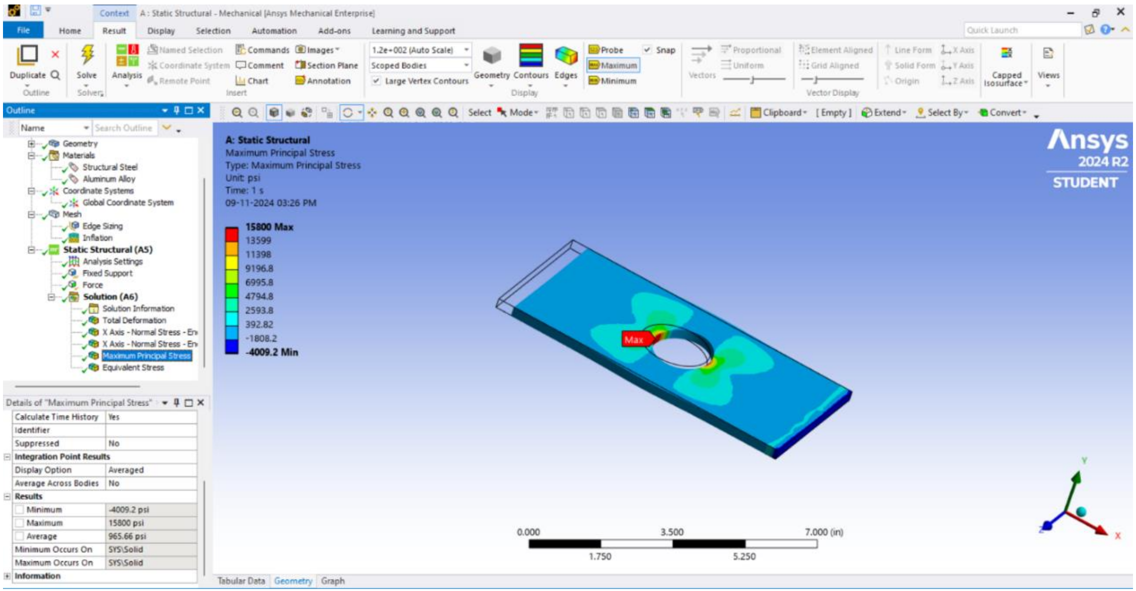


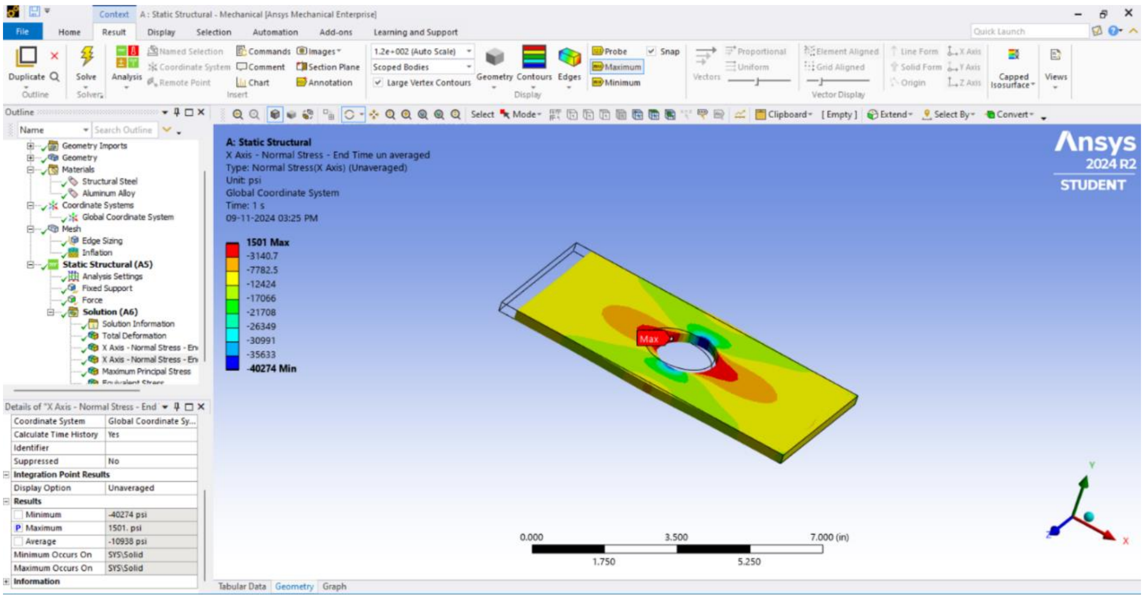

A: Static Structural
Total Deformation
Type: Total Deformation
Unit: in
Time: 1 s
09-11-2024 03:26 PM
0.0035851 Max
0.0031867
0.0027884
0.00239
0.0019917
0.0015934
0.001195
0.00079668
0.00039834
0 Min
Max
Ansys
2024 R2
STUDENT
0.000
3.500
7.000 (in)
1.750
5.250

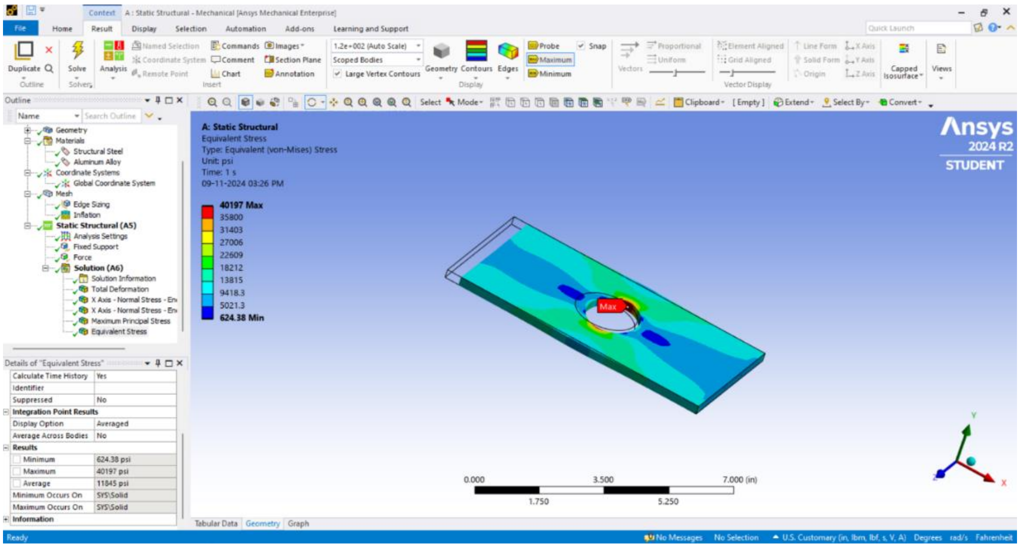

A: Static Structural - Mechanical [Ansys Mechanical Enterprise]
A: Static Structural
Total Deformation
Type: Total Deformation
Unit: in
Time: 1 s
09-11-2024 03:25 PM
0.0035851 Max
0.0031867
0.0027884
0.00239
0.0019917
0.0015934
0.001195
0.00079668
0.00039834
0 Min
Max
Ansys
2024 R2
STUDENT
0.000
3.500
7.000 (in)
1.750
5.250
Details of "Total Deformation"
Minimum
0. in
Maximum
3.5851e-003 in
Average
1.7757e-003 in
Minimum Occurs On
SYS\Solid
Maximum Occurs On
SYS\Solid

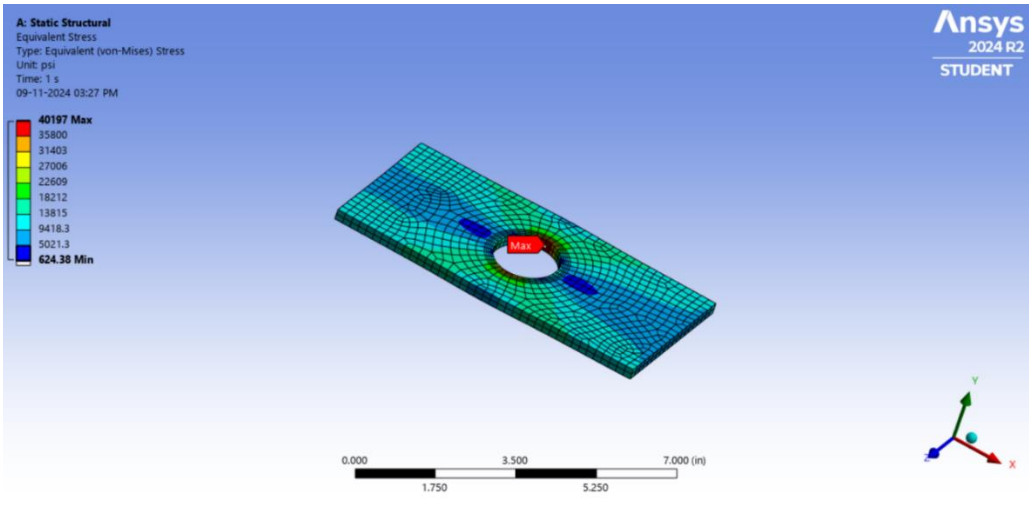

A: Static Structural - Mechanical [Ansys Mechanical Enterprise]
A: Static Structural
X Axis - Normal Stress - End Time
Type: Normal Stress(X Axis)
Unit: psi
Global Coordinate System
Time: 1 s
09-11-2024 03:25 PM
1403.8 Max
-3227.1
-7858
-12489
-17120
-21751
-26382
-31013
-35643
-40274 Min
Max
Ansys
2024 R2
STUDENT
0.000
3.500
7.000 (in)
1.750
5.250


A: Static Structural
X Axis - Normal Stress - End Time
Type: Normal Stress(X Axis)
Unit: psi
Global Coordinate System
Time: 1 s
09-11-2024 03:27 PM
1403.8 Max
-3227.1
-7858
-12489
-17120
-21751
-26382
-31013
-35643
-40274 Min
Max
Ansys
2024 R2
STUDENT
0.000
3.500
7.000 (in)
1.750
5.250


A: Static Structural
Maximum Principal Stress
Type: Maximum Principal Stress
Unit: psi
Time: 1 s
09-11-2024 03:26 PM
15800 Max
13599
11398
9196.8
6995.8
4794.8
2593.8
392.82
-1808.2
-4009.2 Min
Max
Ansys
2024 R2
STUDENT
Details of "Maximum Principal Stress"
Minimum -4009.2 psi
Maximum 15800 psi
Average 965.66 psi
Minimum Occurs On SYS\Solid
Maximum Occurs On SYS\Solid
0.000
3.500
7.000 (in)
1.750
5.250


A: Static Structural
X Axis - Normal Stress - End Time un averaged
Type: Normal Stress(X Axis) (Unaveraged)
Unit: psi
Global Coordinate System
Time: 1 s
09-11-2024 03:25 PM
1501 Max
-3140.7
-7782.5
-12424
-17066
-21708
-26349
-30991
-35633
-40274 Min
Max
Ansys
2024 R2
STUDENT
Display Option Unaveraged
Minimum -40274 psi
Maximum 1501. psi
Average -10938 psi
Minimum Occurs On SYS\Solid
Maximum Occurs On SYS\Solid
0.000
3.500
7.000 (in)
1.750
5.250


A: Static Structural
Equivalent Stress
Type: Equivalent (von-Mises) Stress
Unit: psi
Time: 1 s
09-11-2024 03:26 PM
40197 Max
35800
31403
27006
22609
18212
13815
9418.3
5021.3
624.38 Min
Ansys
2024 R2
STUDENT

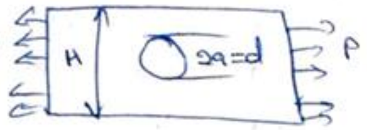

A: Static Structural
Equivalent Stress
Type: Equivalent (von-Mises) Stress
Unit: psi
Time: 1 s
09-11-2024 03:27 PM
40197 Max
35800
31403
27006
22609
18212
13815
9418.3
5021.3
624.38 Min
Max
Ansys
2024 R2
STUDENT
0.000
3.500
7.000 (in)
1.750
5.250

CALCULATION FOR TASK 1

length = 8inch   Applied load = 10000 lbs

width = 4inch

Diameter = 1.75 inch.



Area of rectangle plate

$A = (b-d)t$

$A \Rightarrow (4-1.75)0.25$

$= 2.25 \times 0.25$

$= 0.5625 \text{ inch}^2$

$\sigma_{nor} \Rightarrow \frac{P}{A} \Rightarrow \frac{10000 lbs}{0.5625} = 16200 psi$

stress contraction factor

$\frac{D}{d} \Rightarrow \frac{4}{1.75} = 2.28$

from table the radius ratio is 2.28 and

Kt values is 2.5

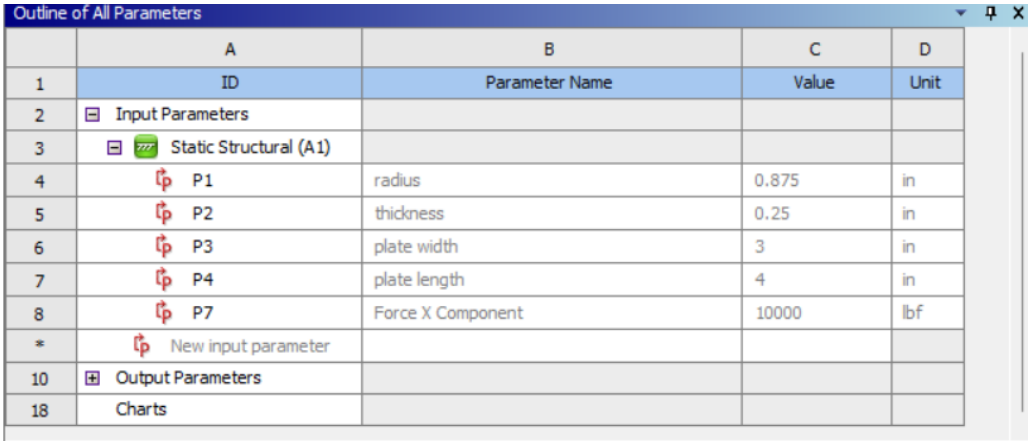
$\sigma_{max} = K_t \times \sigma_{nominal}$

$\sigma_{max} = 2.5 \times 16200$

$= 40500 psi$

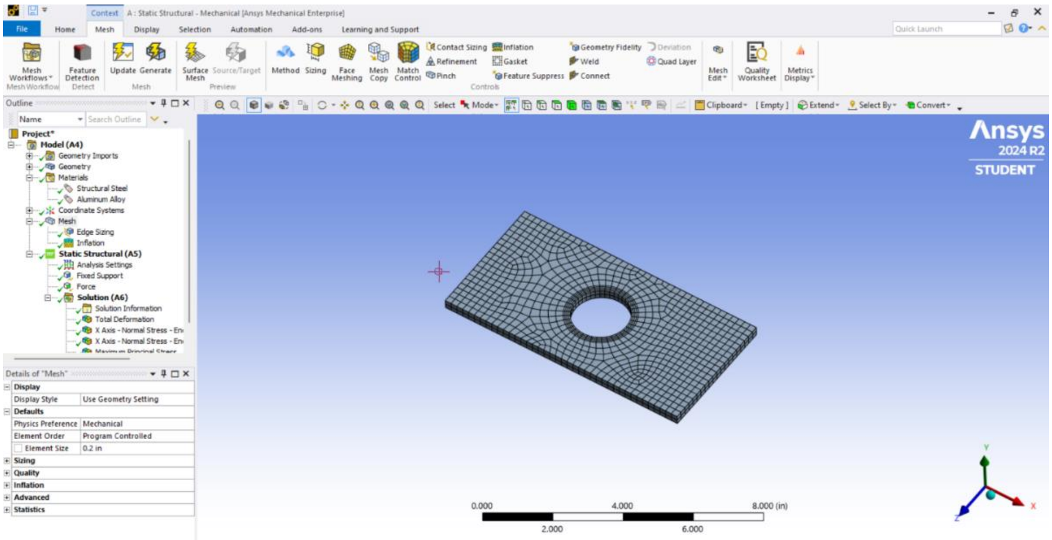
In reality, rectangular plate the material properties , hole diameter and thickness of the plate plays and important role in finding the stress.in the given fig shows a good mesh in the edges of the holes . the stress acting at the hole will shows good deformation. If the are the hole is larger than the rectangular plate in the practical life it not possible as the stress acts on the edges of its shows large deformations and plate will not withstands for the hole diameter.

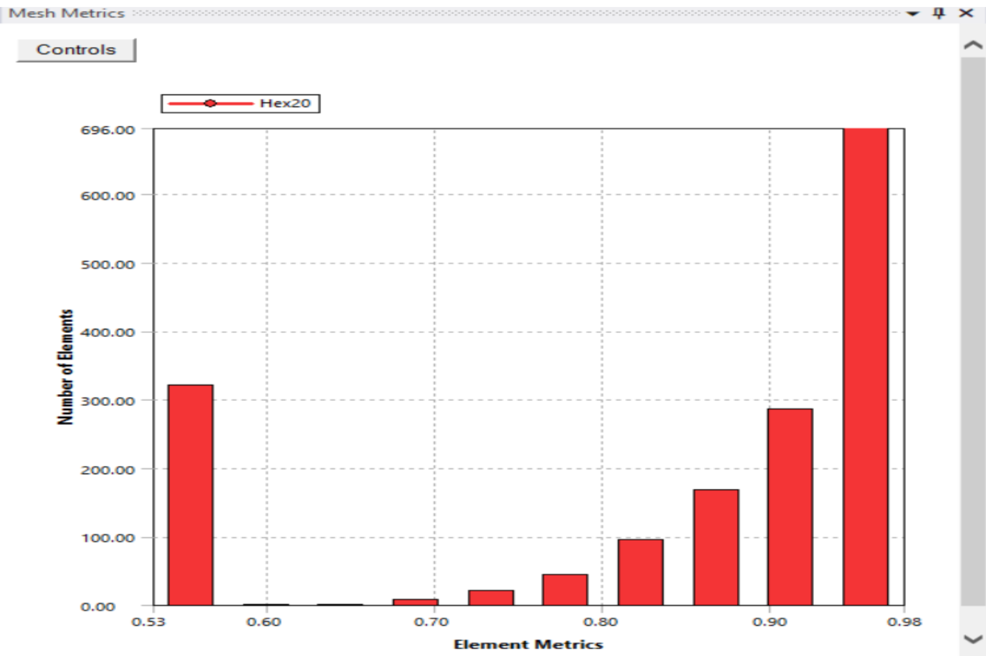
Example 2

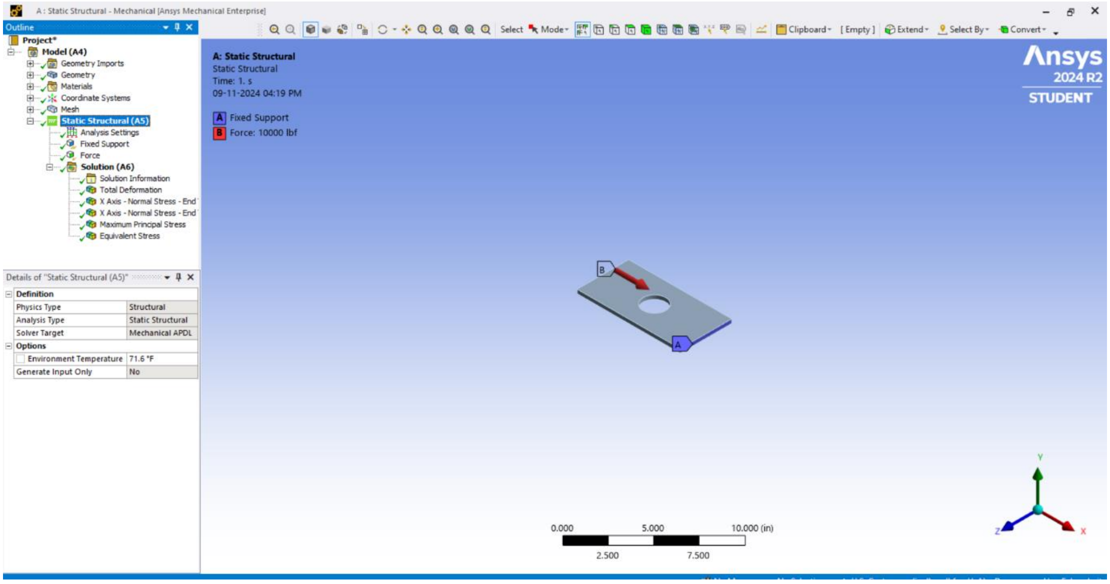


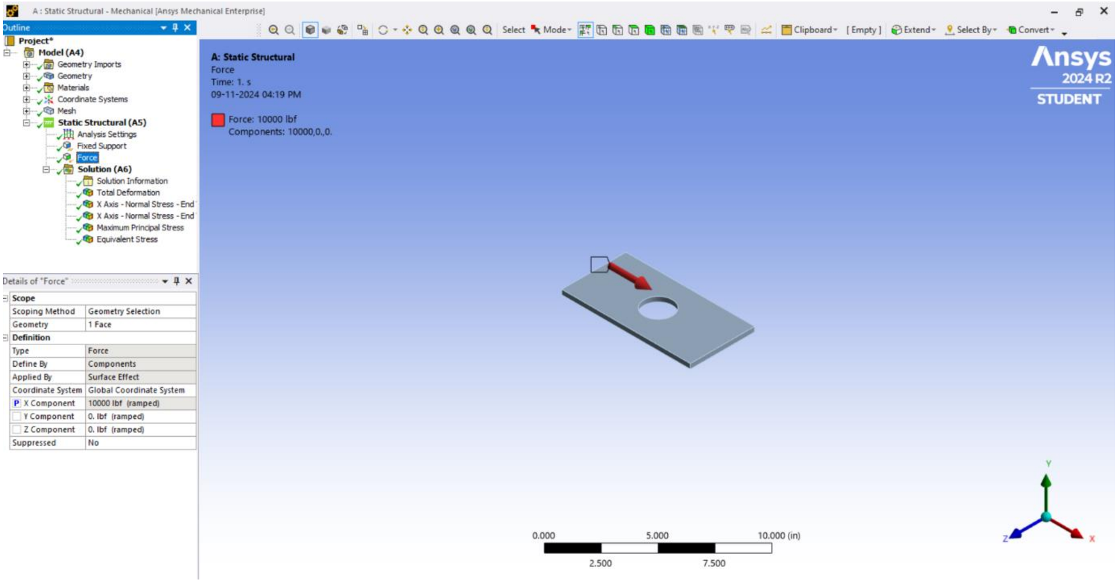
Outline of All Parameters

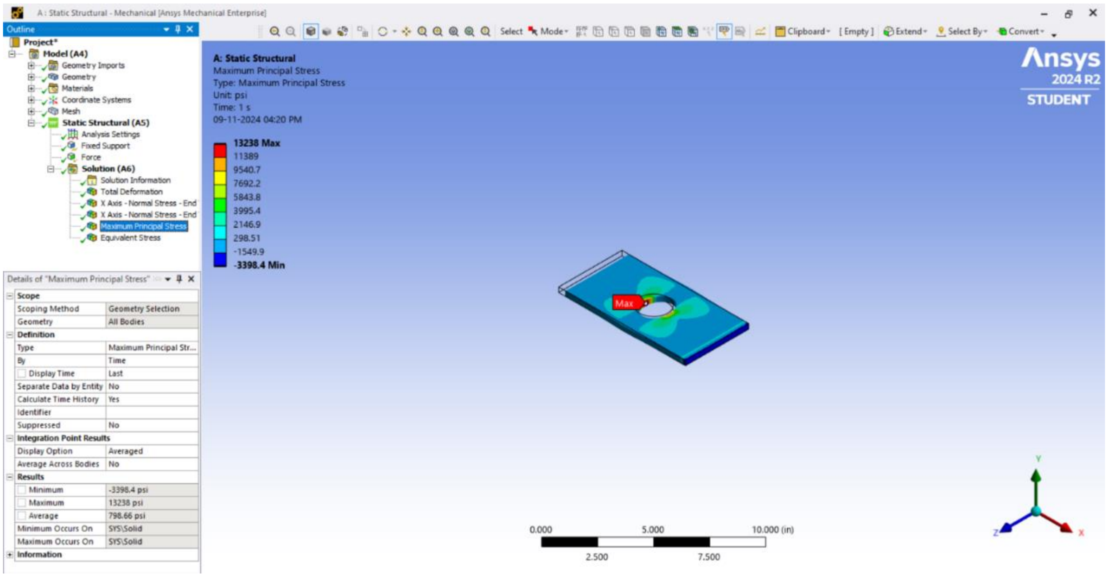
	A	B	C	D
1	ID	Parameter Name	Value	Unit
2	Input Parameters			
3	Static Structural (A1)			
4	P1	radius	0.875	in
5	P2	thickness	0.25	in
6	P3	plate width	3	in
7	P4	plate length	4	in
8	P7	Force X Component	10000	lbf
*	New input parameter			
10	Output Parameters			
18	Charts			

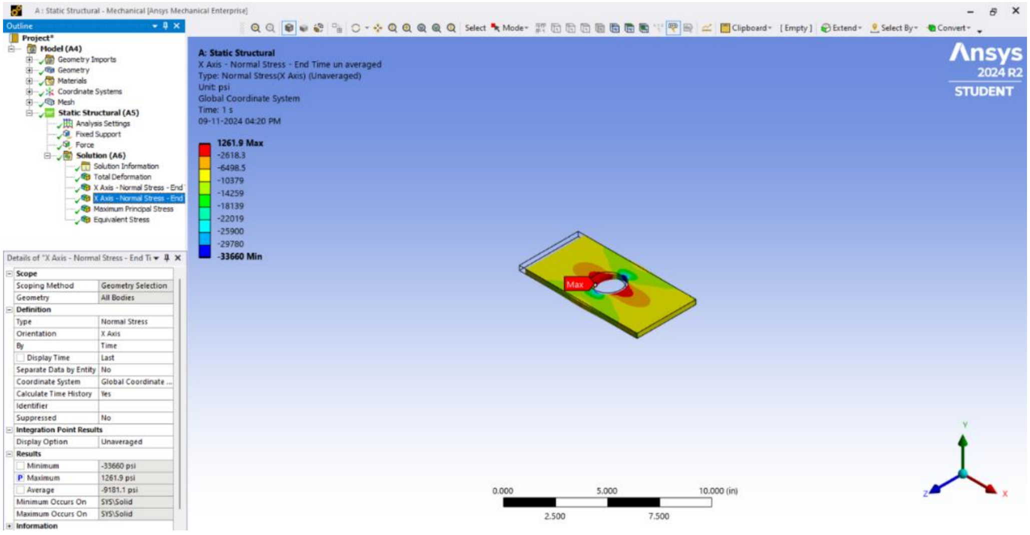


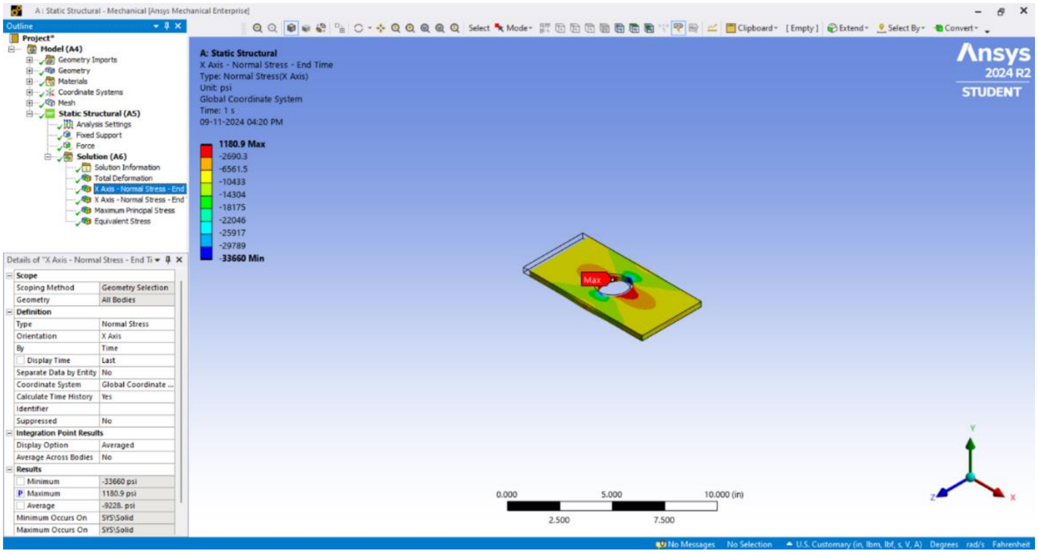


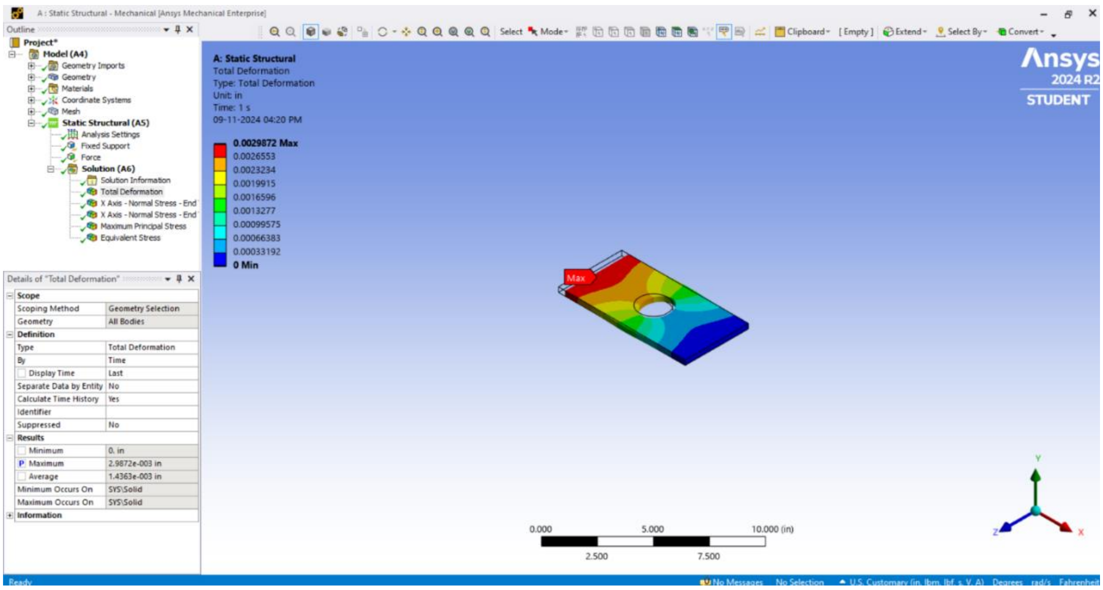

A : Static Structural - Mechanical [Ansys Mechanical Enterprise]
Outline
Project*
Model (A4)
Geometry Imports
Geometry
Materials
Coordinate Systems
Mesh
Static Structural (A5)
Analysis Settings
Fixed Support
Force
Solution (A6)
Solution Information
Total Deformation
X Axis - Normal Stress - End
X Axis - Normal Stress - End
Maximum Principal Stress
Equivalent Stress
Details of "Static Structural (A5)"
Definition
Physics Type Structural
Analysis Type Static Structural
Solver Target Mechanical APDL
Options
Environment Temperature 71.6 °F
Generate Input Only No
A: Static Structural
Static Structural
Time: 1. s
09-11-2024 04:19 PM
A Fixed Support
B Force: 10000 lbf
Ansys
2024 R2
STUDENT
0.000 5.000 10.000 (in)
2.500 7.500

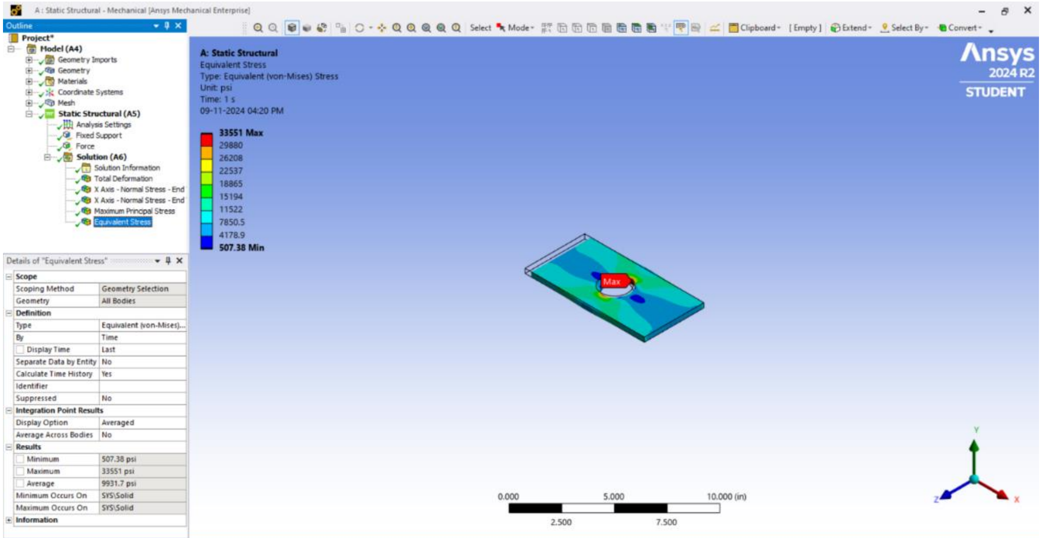

A : Static Structural - Mechanical [Ansys Mechanical Enterprise]
Outline
Project*
Model (A4)
Geometry Imports
Geometry
Materials
Coordinate Systems
Mesh
Static Structural (A5)
Analysis Settings
Fixed Support
Force
Solution (A6)
Solution Information
Total Deformation
X Axis - Normal Stress - End
X Axis - Normal Stress - End
Maximum Principal Stress
Equivalent Stress
Details of "Force"
Scope
Scoping Method Geometry Selection
Geometry 1 Face
Definition
Type Force
Define By Components
Applied By Surface Effect
Coordinate System Global Coordinate System
X Component 10000 lbf (ramped)
Y Component 0. lbf (ramped)
Z Component 0. lbf (ramped)
Suppressed No
A: Static Structural
Force
Time: 1. s
09-11-2024 04:19 PM
Force: 10000 lbf
Components: 10000,0,0.
Ansys
2024 R2
STUDENT
0.000 5.000 10.000 (in)
2.500 7.500


A : Static Structural - Mechanical [Ansys Mechanical Enterprise]
Outline
Project*
Model (A4)
Geometry Imports
Geometry
Materials
Coordinate Systems
Mesh
Static Structural (A5)
Analysis Settings
Fixed Support
Force
Solution (A6)
Solution Information
Total Deformation
X Axis - Normal Stress - End
X Axis - Normal Stress - End
Maximum Principal Stress
Equivalent Stress
Details of "Maximum Principal Stress"
Scope
Scoping Method Geometry Selection
Geometry All Bodies
Definition
Type Maximum Principal Str...
By Time
Display Time Last
Separate Data by Entity No
Calculate Time History Yes
Identifier
Suppressed No
Integration Point Results
Display Option Averaged
Average Across Bodies No
Results
Minimum -3398.4 psi
Maximum 13238 psi
Average 798.66 psi
Minimum Occurs On SYS\Solid
Maximum Occurs On SYS\Solid
Information
A: Static Structural
Maximum Principal Stress
Type: Maximum Principal Stress
Unit: psi
Time: 1 s
09-11-2024 04:20 PM
13238 Max
11389
9540.7
7692.2
5843.8
3995.4
2146.9
298.51
-1549.9
-3398.4 Min
Max
Ansys
2024 R2
STUDENT
0.000 5.000 10.000 (in)
2.500 7.500


A: Static Structural
X Axis - Normal Stress - End Time un averaged
Type: Normal Stress(X Axis) (Unaveraged)
Unit: psi
Global Coordinate System
Time: 1 s
09-11-2024 04:20 PM
1261.9 Max
-2618.3
-6498.5
-10379
-14259
-18139
-22019
-25900
-29780
-33660 Min
Ansys
2024 R2
STUDENT
Max
Minimum -33660 psi
Maximum 1261.9 psi
Average -9181.1 psi
0.000
5.000
10.000 (in)
2.500
7.500


A: Static Structural
X Axis - Normal Stress - End Time
Type: Normal Stress(X Axis)
Unit: psi
Global Coordinate System
Time: 1 s
09-11-2024 04:20 PM
1180.9 Max
-2690.3
-6561.5
-10433
-14304
-18175
-22046
-25917
-29789
-33660 Min
Ansys
2024 R2
STUDENT
Max
Minimum -33660 psi
Maximum 1180.9 psi
Average -9228. psi
0.000
5.000
10.000 (in)
2.500
7.500


A: Static Structural
Total Deformation
Type: Total Deformation
Unit: in
Time: 1 s
09-11-2024 04:20 PM
0.0029872 Max
0.0026553
0.0023234
0.0019915
0.0016596
0.0013277
0.00099575
0.00066383
0.00033192
0 Min
Ansys
2024 R2
STUDENT
Max
Minimum 0. in
Maximum 2.9872e-003 in
Average 1.4363e-003 in
0.000
5.000
10.000 (in)
2.500
7.500



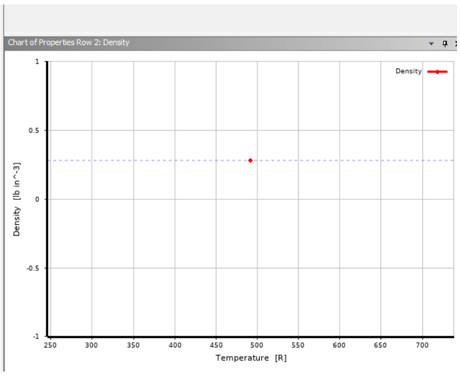
ALUMINUM ALLOY

Properties of Outline Row 4: Aluminum Alloy

	A	B	C
1	Property	Value	Unit
2	Density	0.10007	lb in^-3
3	⊞ Isotropic Secant Coefficient of Thermal Expansion		
5	⊟ Isotropic Elasticity		
6	Derive from	Young's Modulus and Poisson's...	
7	Young's Modulus	1.0298E+07	psi
8	Poisson's Ratio	0.33	
9	Bulk Modulus	1.0096E+07	psi
10	Shear Modulus	3.8713E+06	psi
11	⊞ S-N Curve	Tabular	
15	Tensile Yield Strength	40611	psi
16	Compressive Yield Strength	40611	psi
17	Tensile Ultimate Strength	44962	psi
18	Compressive Ultimate Strength	0	psi

STRUCTRUAL STEEL

	A	B	C
1	Property	Value	Unit
2	Density	0.2836	lb in^-3
3	⊞ Isotropic Secant Coefficient of Thermal Expansion		
5	⊟ Isotropic Elasticity		
6	Derive from	Young's Modulus and Poisson's...	
7	Young's Modulus	2.9008E+07	psi
8	Poisson's Ratio	0.3	
9	Bulk Modulus	2.4173E+07	psi
10	Shear Modulus	1.1157E+07	psi
11	⊟ Strain-Life Parameters		
12	Display Curve Type	Strain-Life	
13	Strength Coefficient	1.3343E+05	psi
14	Strength Exponent	-0.106	
15	Ductility Coefficient	0.213	
16	Ductility Exponent	-0.47	
17	Cyclic Strength Coefficient	1.4504E+05	psi
18	Cyclic Strain Hardening Exponent	0.2	
19	⊞ S-N Curve	Tabular	
23	Tensile Yield Strength	36259	psi
24	Compressive Yield Strength	36259	psi
25	Tensile Ultimate Strength	66717	psi
26	Compressive Ultimate Strength	0	psi



EXAMPLE 2

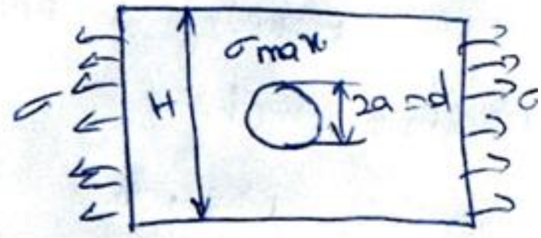
2) Radius $= 0.875$ inch.

$D = 1.75$ inch

thickness $= 0.2$ inch.

width $= 6$

length $= 8$.



$\text{Area} = (b-d)t \Rightarrow (6-1.75)0.3$

$\Rightarrow 4.25 \times 0.3 = 0.85 \text{ inch}^2$

$\sigma_{normal} \Rightarrow \frac{P}{A} \Rightarrow \frac{10000}{0.85} = 11764.706 \text{psi}$

stress contraction factor K_t

$\frac{w}{d} \Rightarrow \frac{6}{1.75} = 3.4$

from table the fillet radius ratio is 3.4 and K_t value is 2.8

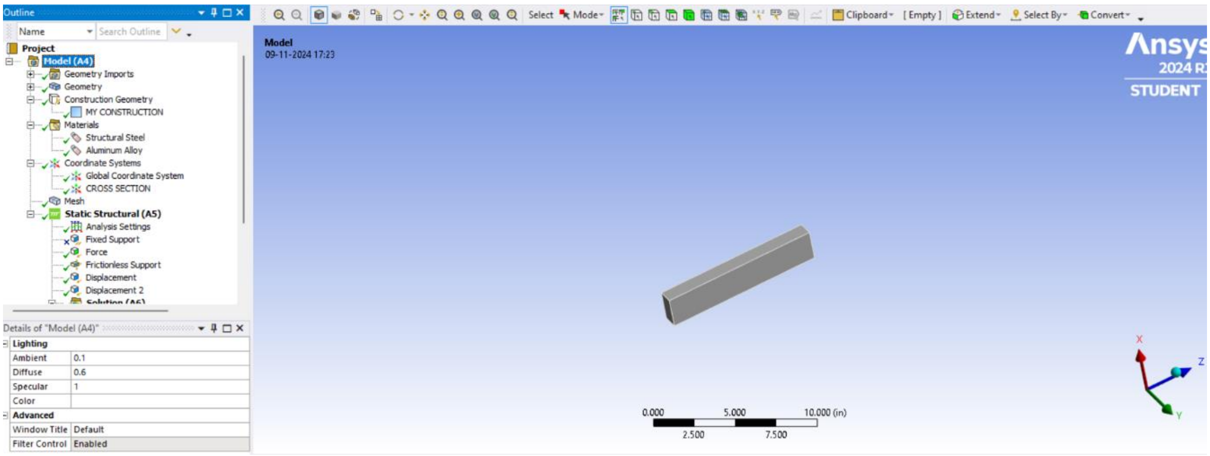
maximum stress σ_{max} at hole

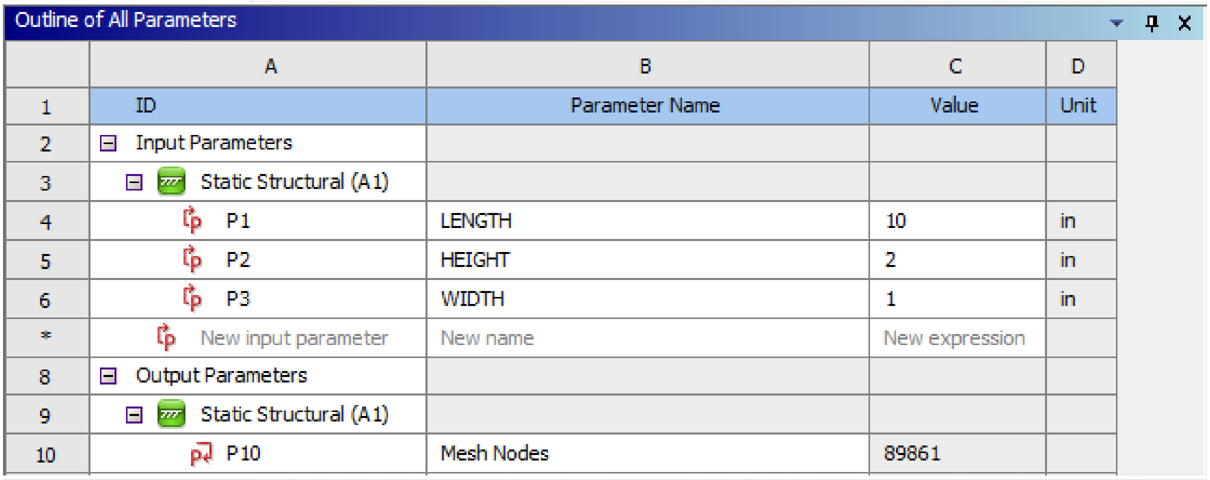
$\sigma_{max} \Rightarrow K_t \times \sigma_{nom}$

$\Rightarrow 2.8 \times 11764.706$

$\Rightarrow 32939.2 \text{ psi}$

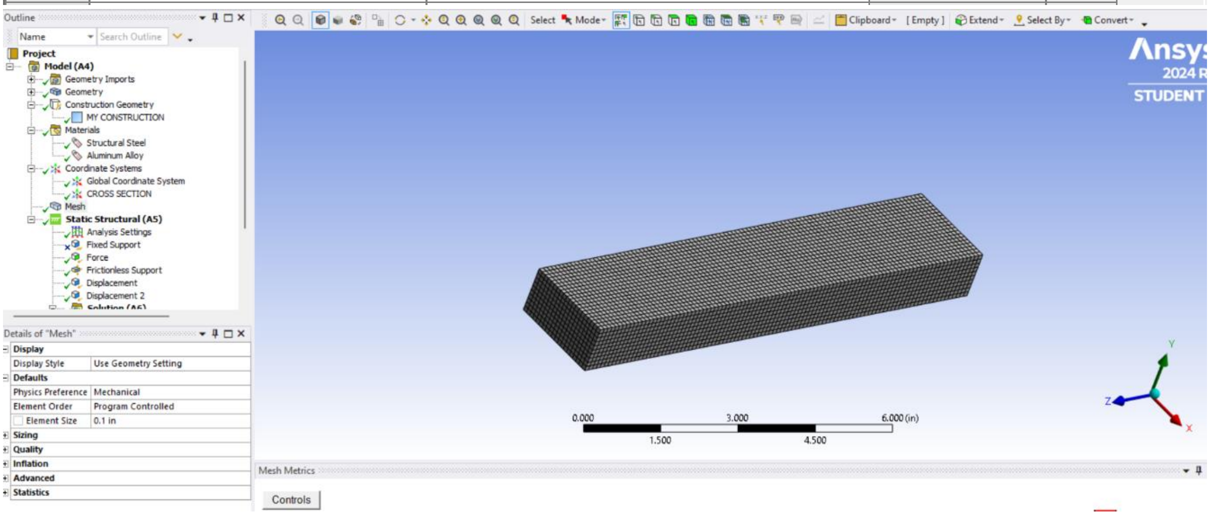
Task 2

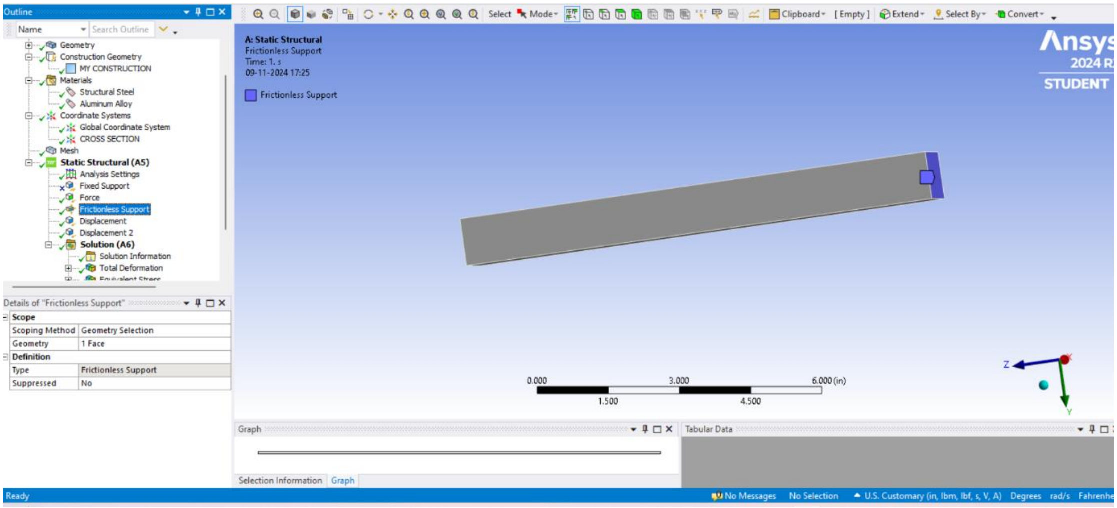


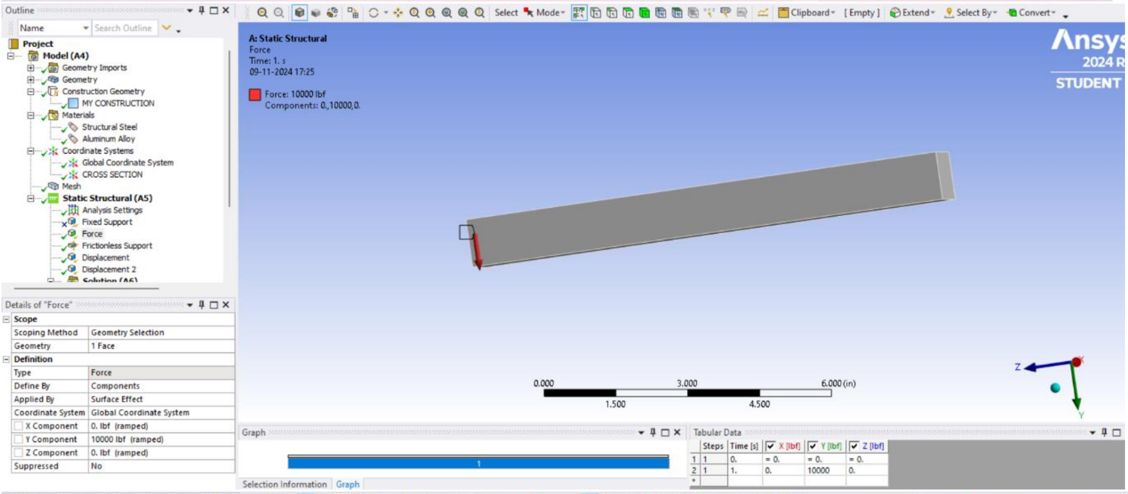


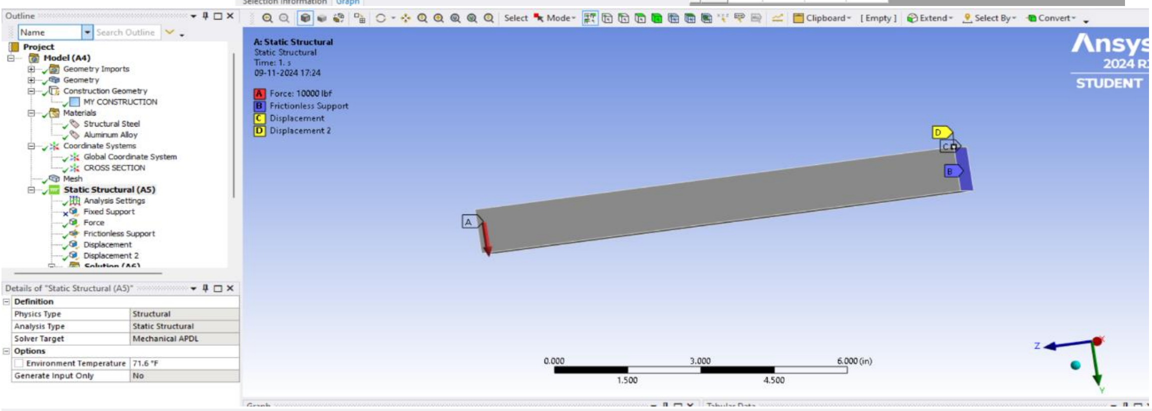
Outline of All Parameters

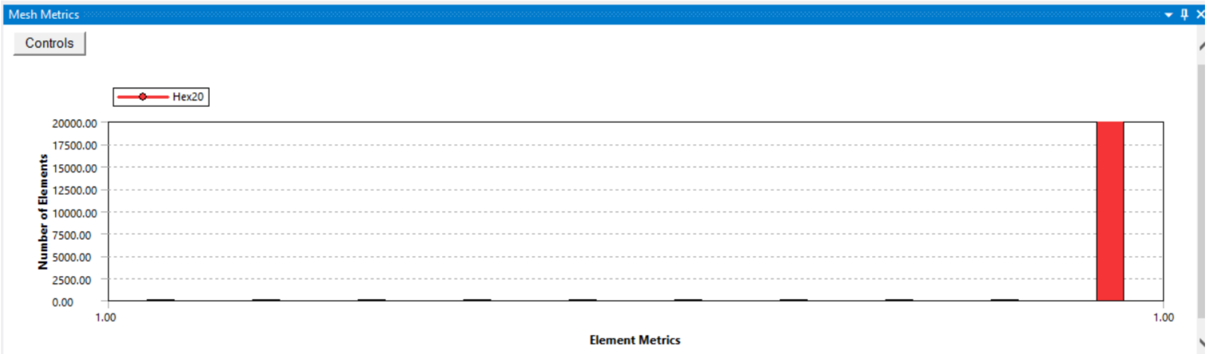
	A	B	C	D
1	ID	Parameter Name	Value	Unit
2	Input Parameters			
3	Static Structural (A1)			
4	P1	LENGTH	10	in
5	P2	HEIGHT	2	in
6	P3	WIDTH	1	in
*	New input parameter	New name	New expression	
8	Output Parameters			
9	Static Structural (A1)			
10	P10	Mesh Nodes	89861	

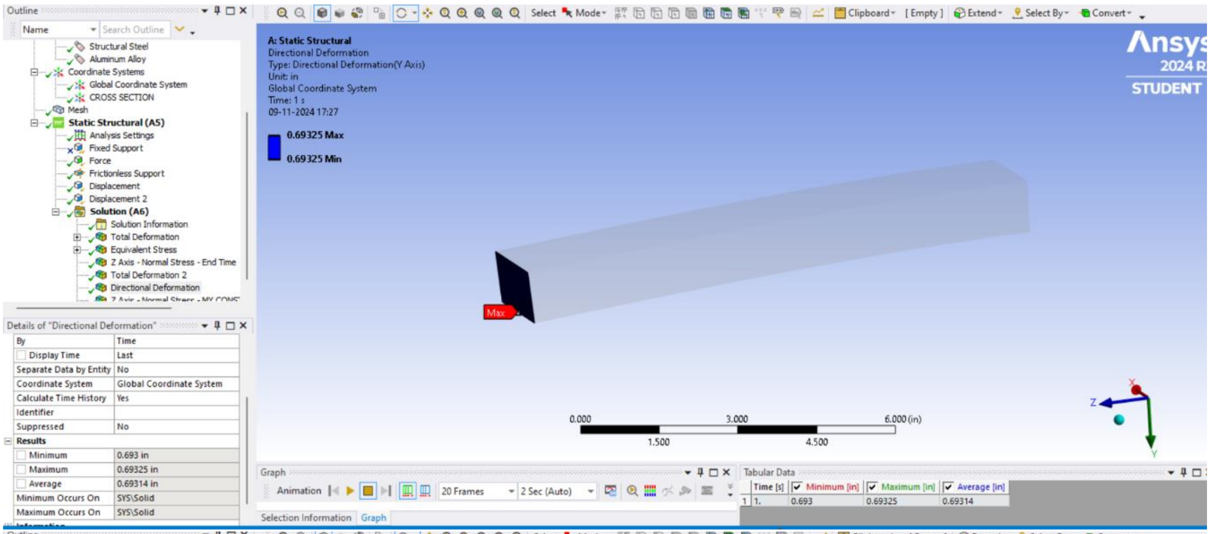


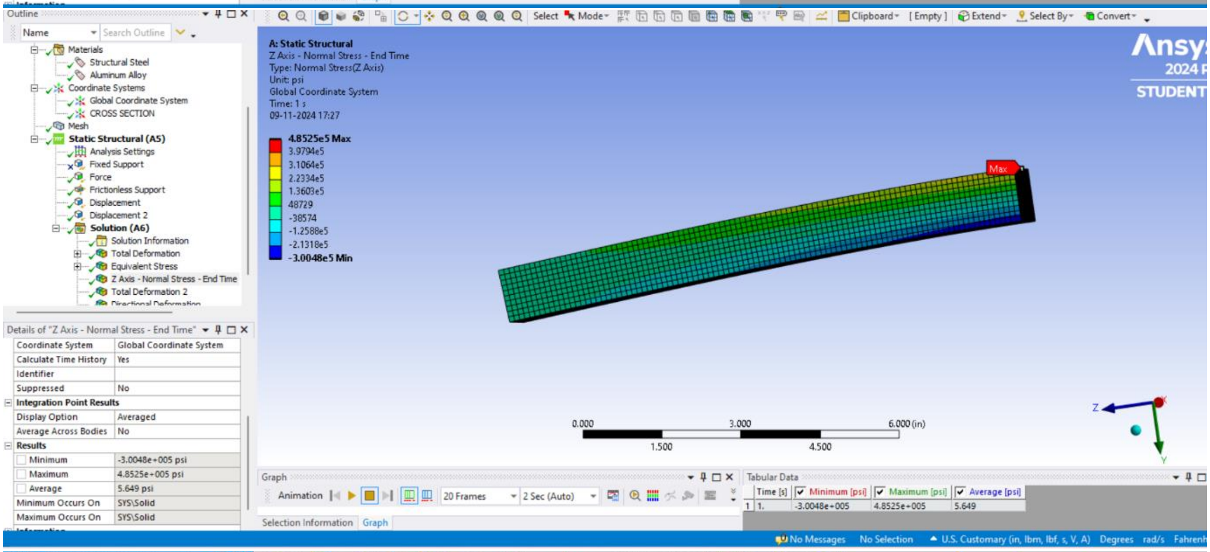

A: Static Structural
Frictionless Support
Time: 1. s
09-11-2024 17:25
Frictionless Support
Ansys
2024 R
STUDENT
Details of "Frictionless Support"
Scope
Scoping Method | Geometry Selection
Geometry | 1 Face
Definition
Type | Frictionless Support
Suppressed | No
0.000
3.000
6.000 (in)
1.500
4.500

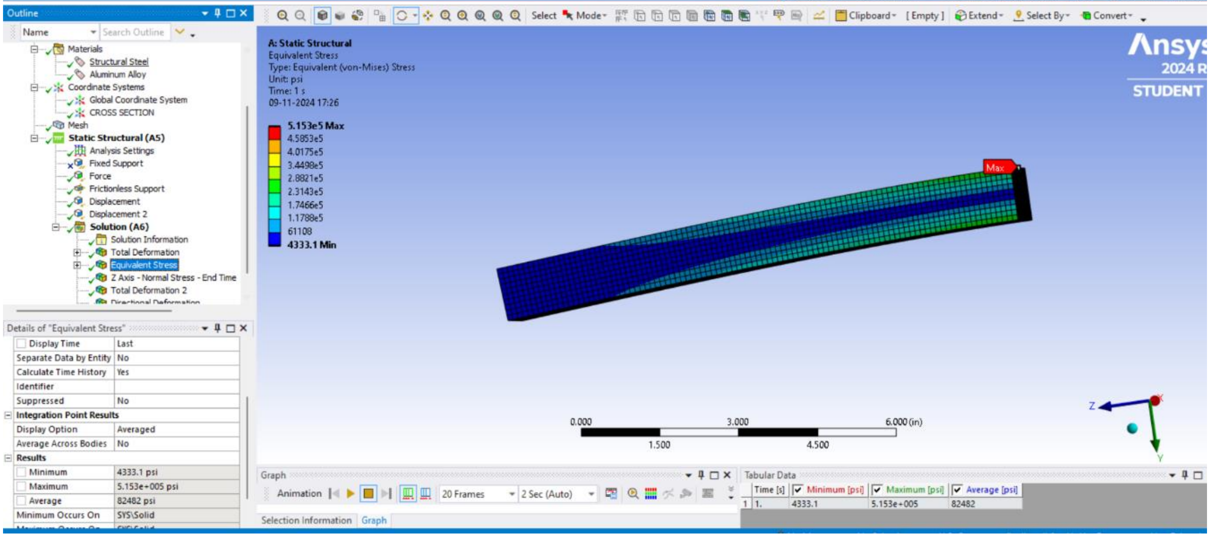

A: Static Structural
Force
Time: 1. s
09-11-2024 17:25
Force: 10000 lbf
Components: 0.,10000,0.
Ansys
2024 R
STUDENT
Details of "Force"
Scope
Scoping Method | Geometry Selection
Geometry | 1 Face
Definition
Type | Force
Define By | Components
Applied By | Surface Effect
Coordinate System | Global Coordinate System
X Component | 0. lbf (ramped)
Y Component | 10000 lbf (ramped)
Z Component | 0. lbf (ramped)
Suppressed | No
0.000
3.000
6.000 (in)
1.500
4.500

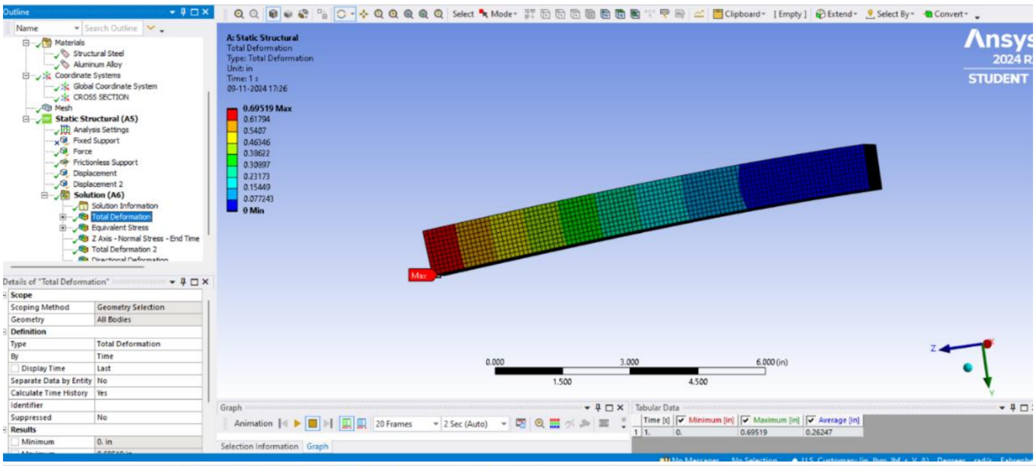

A: Static Structural
Static Structural
Time: 1. s
09-11-2024 17:24
A Force: 10000 lbf
B Frictionless Support
C Displacement
D Displacement 2
Ansys
2024 R
STUDENT
Details of "Static Structural (A5)"
Definition
Physics Type | Structural
Analysis Type | Static Structural
Solver Target | Mechanical APDL
Options
Environment Temperature | 71.6 °F
Generate Input Only | No
0.000
3.000
6.000 (in)
1.500
4.500

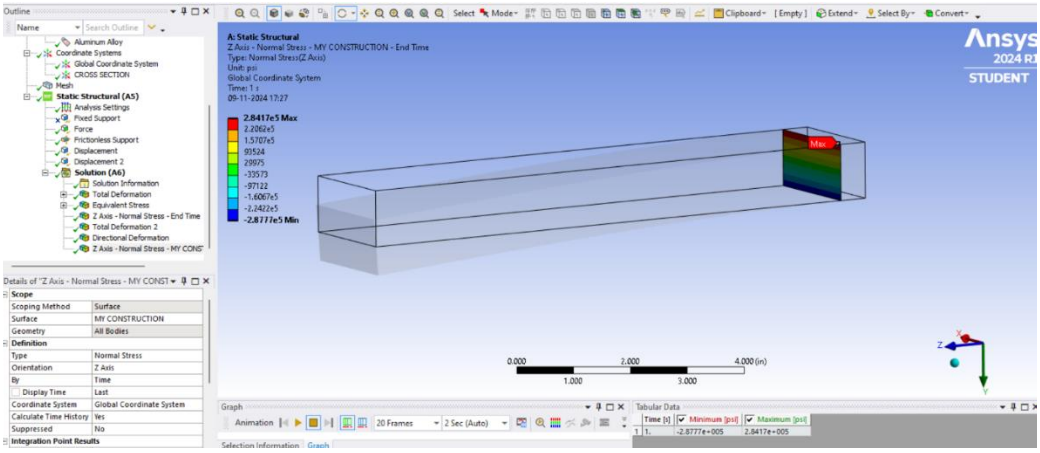

Mesh Metrics
Controls
Hex20
20000.00
17500.00
15000.00
12500.00
10000.00
7500.00
5000.00
2500.00
0.00
Number of Elements
1.00
1.00
Element Metrics


A: Static Structural
Directional Deformation
Type: Directional Deformation(Y Axis)
Unit: in
Global Coordinate System
Time: 1 s
09-11-2024 17:27
0.69325 Max
0.69325 Min
Max
Details of "Directional Deformation"
Minimum 0.693 in
Maximum 0.69325 in
Average 0.69314 in
Minimum Occurs On SYS\Solid
Maximum Occurs On SYS\Solid
Ansys 2024 R STUDENT


Z Axis - Normal Stress - End Time
Type: Normal Stress(Z Axis)
Unit: psi
Global Coordinate System
Time: 1 s
09-11-2024 17:27
4.8525e5 Max
3.9794e5
3.1064e5
2.2334e5
1.3603e5
48729
-38574
-1.2588e5
-2.1318e5
-3.0048e5 Min
Max
Details of "Z Axis - Normal Stress - End Time"
Minimum -3.0048e+005 psi
Maximum 4.8525e+005 psi
Average 5.649 psi
Minimum Occurs On SYS\Solid
Maximum Occurs On SYS\Solid


A: Static Structural
Equivalent Stress
Type: Equivalent (von-Mises) Stress
Unit: psi
Time: 1 s
09-11-2024 17:26
5.153e5 Max
4.5853e5
4.0175e5
3.4498e5
2.8821e5
2.3143e5
1.7466e5
1.1788e5
61108
4333.1 Min
Max
Details of "Equivalent Stress"
Minimum 4333.1 psi
Maximum 5.153e+005 psi
Average 82482 psi
Minimum Occurs On SYS\Solid





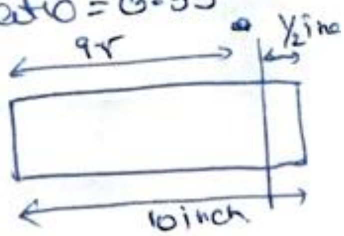
Properties of Outline Row 4: Aluminum Alloy

	A	B	C
1	Property	Value	Unit
2	Density	0.10007	lb in^-3
3	Isotropic Secant Coefficient of Thermal Expansion		
5	Isotropic Elasticity		
6	Derive from	Young's Modulus and Poisson's...	
7	Young's Modulus	1.0298E+07	psi
8	Poisson's Ratio	0.33	
9	Bulk Modulus	1.0096E+07	psi
10	Shear Modulus	3.8713E+06	psi
11	S-N Curve	Tabular	
15	Tensile Yield Strength	40611	psi
16	Compressive Yield Strength	40611	psi
17	Tensile Ultimate Strength	44962	psi
18	Compressive Ultimate Strength	0	psi

EXAMPLE 1

2) thickness = 1 inch
height = 2 inch.
length = 10 inch

youngs modules = 1.029×10^{7}
possion's Ratio = 0.33



$I = \frac{1}{12}h^3 b \Rightarrow \frac{1}{12}\times(2)^3\times b$

$= \frac{1}{12}\times 8\times 1 = 0.667$

$M \Rightarrow P \times L$

$\Rightarrow 10000 \times (10 - \tfrac{1}{2})$

$= 10000 \times 9.5 = 95000$

$c = \frac{1}{2}\times h = \frac{1}{2}\times 2 = 1$

$\sigma_c \Rightarrow \frac{MC}{I} \Rightarrow \frac{95000\times 1}{0.667} = 1.423\times10^5$ psi

from table $k_t = 2.4$

$\sigma_{max} \Rightarrow k_t \times 1.423\times10^5$

$\Rightarrow 2.4 \times 1.423\times10^5$

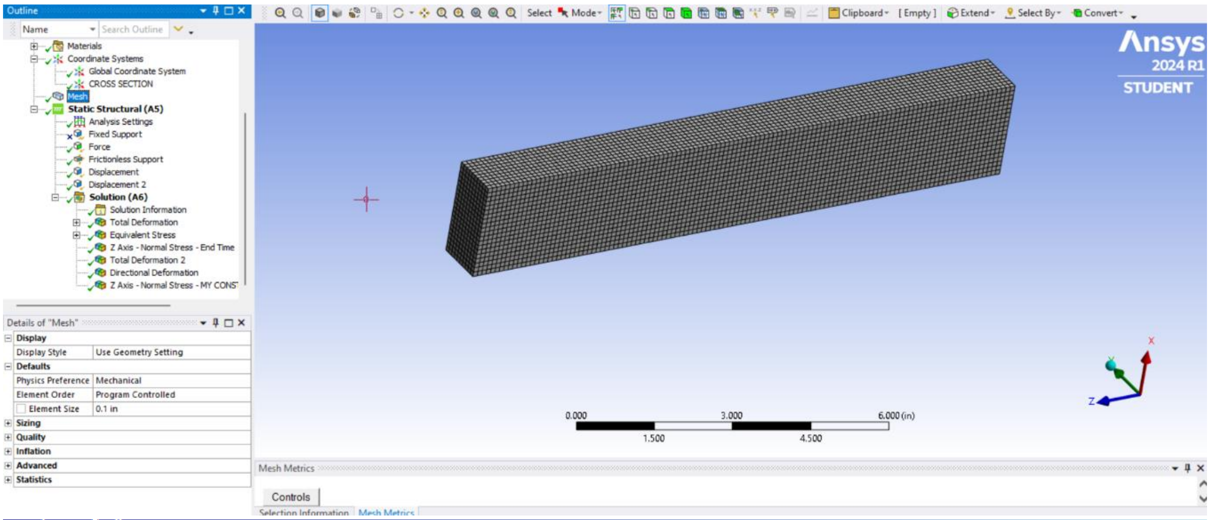
34152 psi

$y = \frac{PL^3}{3EI} = \frac{10000\times(10)^3}{3\times1.029\times10^7\times0.667}$

$y \Rightarrow 0.04856727$

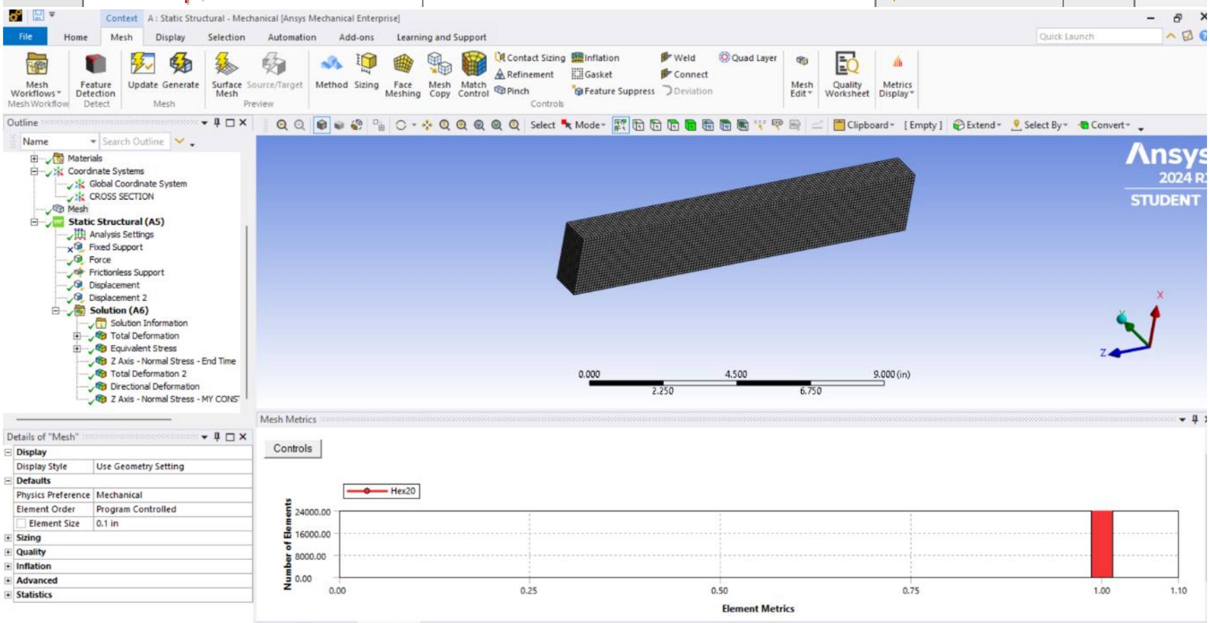
The bending stress of the rectangular bar is determined by manumally as well as ansys shows a minimal differences so the rectangular bar can withstand in the stress . the mesh shows goods so we can find the deformation half inch away from the edges shows at the sufaces shows the rectangular bar can withstand for given loads and shows a small deformation in the edges.

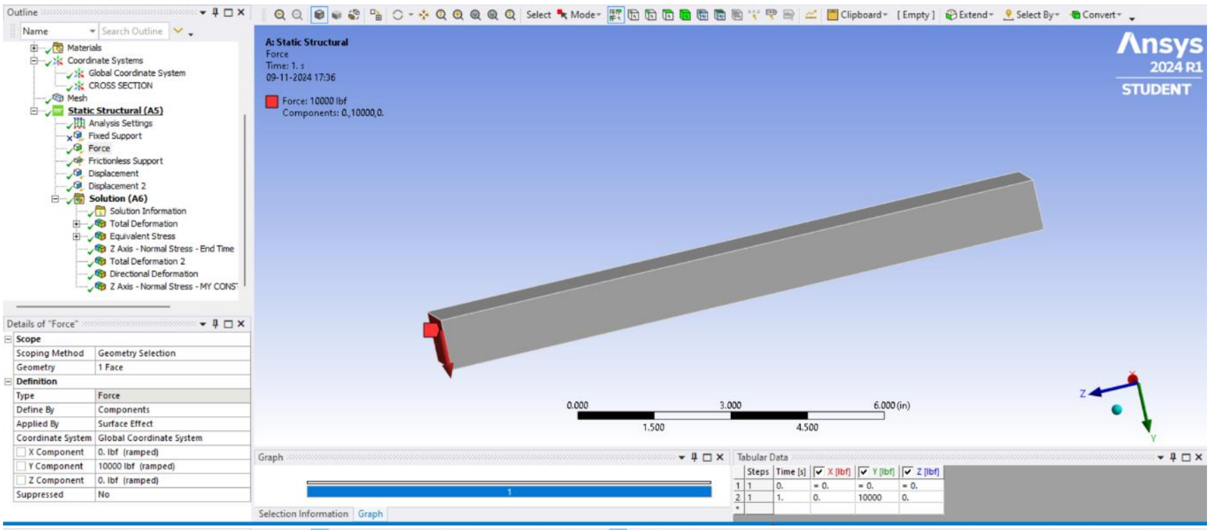
EXAMPLE 2

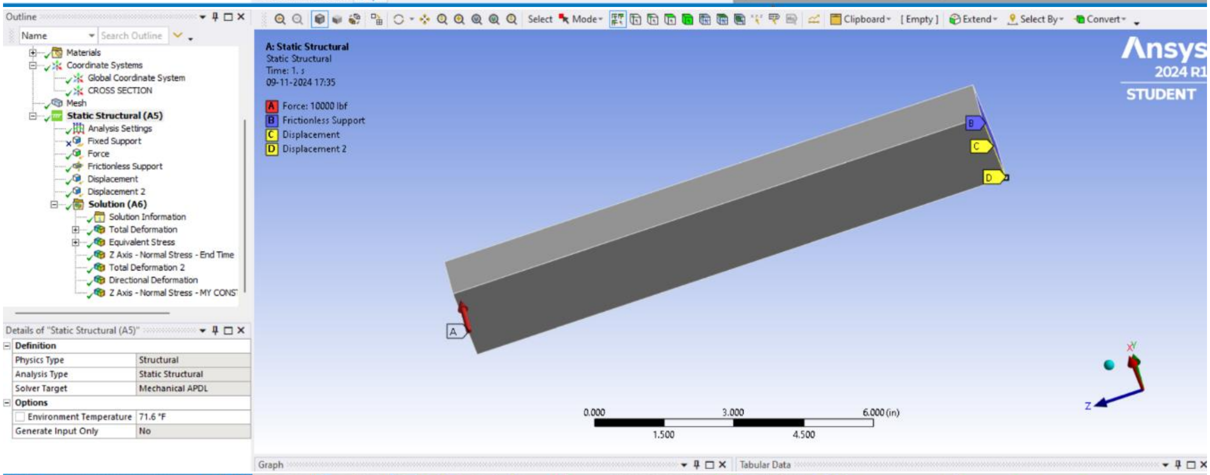


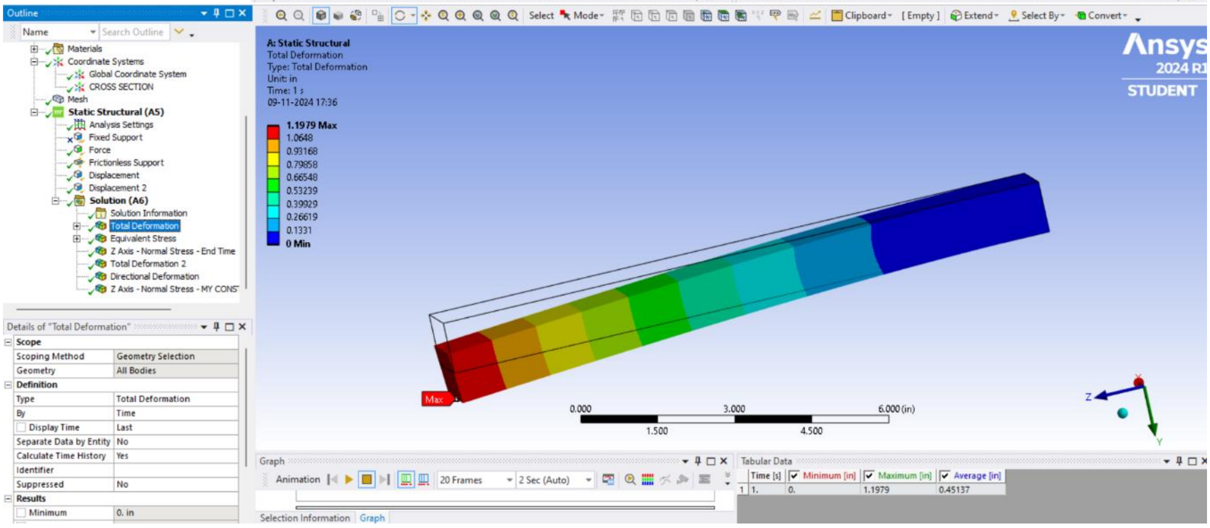
Outline of All Parameters

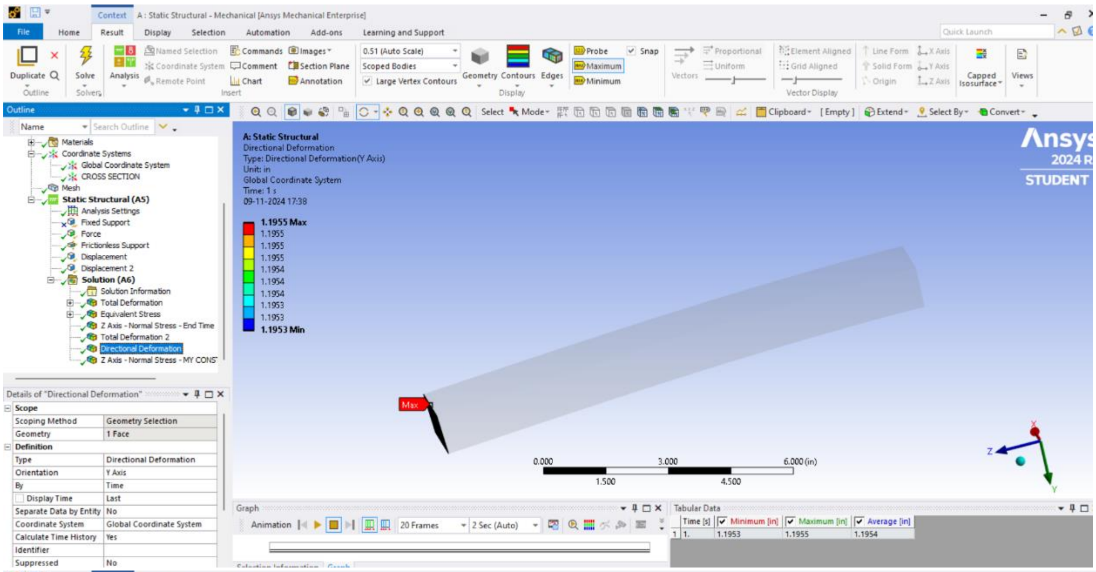
	A	B	C	D
1	ID	Parameter Name	Value	Unit
2	Input Parameters			
3	Static Structural (A1)			
4	P1	LENGTH	12	in
5	P2	HEIGHT	2	in
6	P3	WIDTH	1	in
*	New input parameter			
8	Output Parameters			
9	Static Structural (A1)			
10	P10	Mesh Nodes	1.1615E+05	

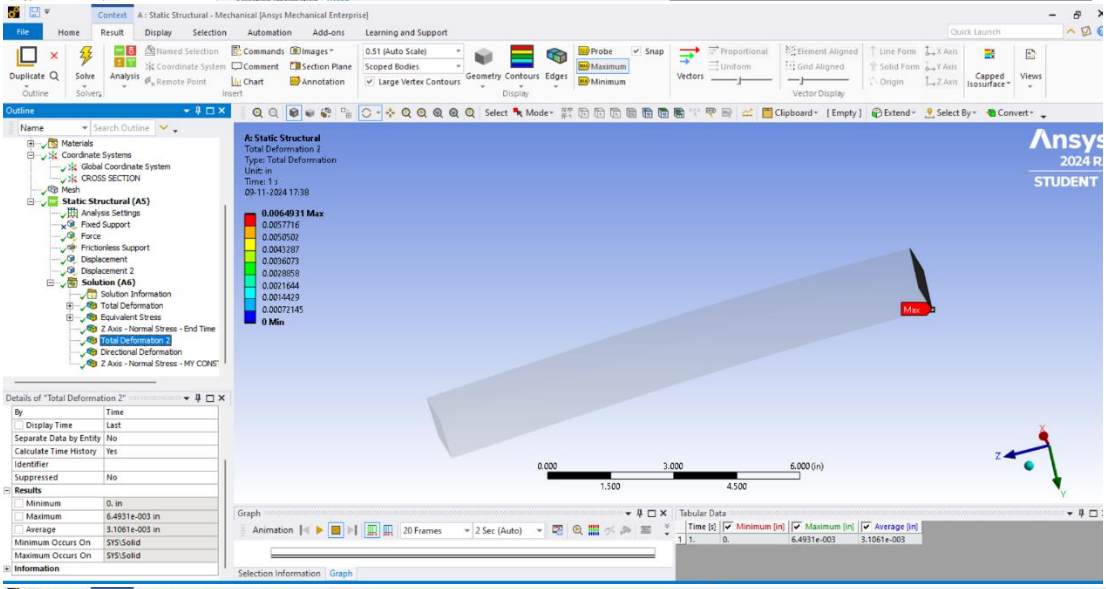


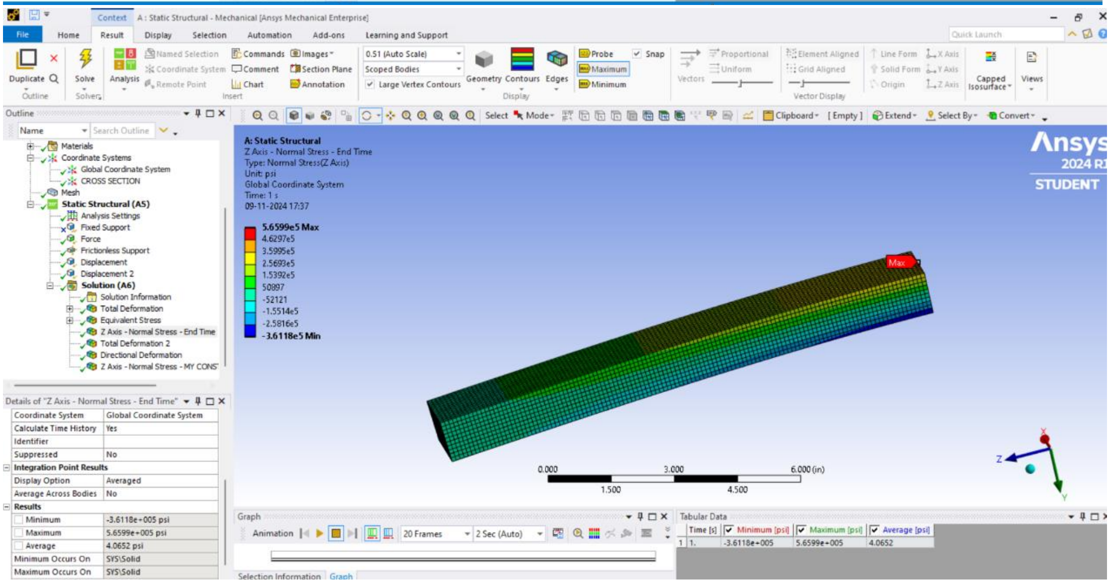

A: Static Structural
Force
Time: 1. s
09-11-2024 17:36
Force: 10000 lbf
Components: 0.,10000,0.
Ansys
2024 R1
STUDENT
Details of "Force"
Scope
Scoping Method Geometry Selection
Geometry 1 Face
Definition
Type Force
Define By Components
Applied By Surface Effect
Coordinate System Global Coordinate System
X Component 0. lbf (ramped)
Y Component 10000 lbf (ramped)
Z Component 0. lbf (ramped)
Suppressed No
Tabular Data
Steps Time [s] X [lbf] Y [lbf] Z [lbf]
1 1 0. = 0. = 0. = 0.
2 1 1. 0. 10000 0.

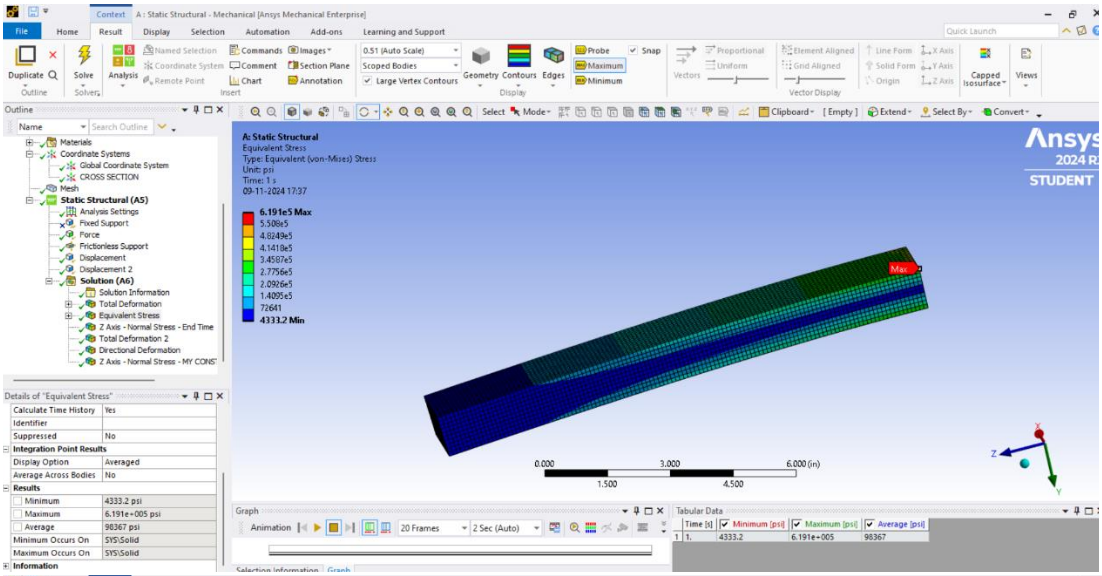

A: Static Structural
Static Structural
Time: 1. s
09-11-2024 17:35
A Force: 10000 lbf
B Frictionless Support
C Displacement
D Displacement 2
Ansys
2024 R1
STUDENT
Details of "Static Structural (A5)"
Definition
Physics Type Structural
Analysis Type Static Structural
Solver Target Mechanical APDL
Options
Environment Temperature 71.6 °F
Generate Input Only No

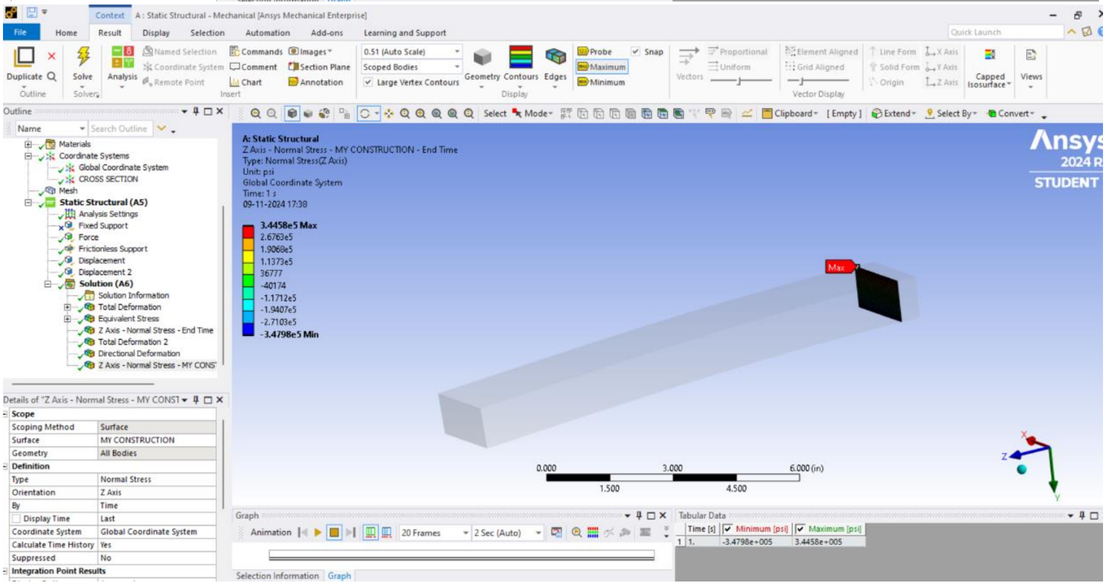

A: Static Structural
Total Deformation
Type: Total Deformation
Unit: in
Time: 1 s
09-11-2024 17:36
1.1979 Max
1.0648
0.93168
0.79858
0.66548
0.53239
0.39929
0.26619
0.1331
0 Min
Ansys
2024 R1
STUDENT
Details of "Total Deformation"
Scope
Scoping Method Geometry Selection
Geometry All Bodies
Definition
Type Total Deformation
By Time
Display Time Last
Separate Data by Entity No
Calculate Time History Yes
Suppressed No
Results
Minimum 0. in
Tabular Data
Time [s] Minimum [in] Maximum [in] Average [in]
1 1. 0. 1.1979 0.45137


A: Static Structural
Directional Deformation
Type: Directional Deformation(Y Axis)
Unit: in
Global Coordinate System
Time: 1 s
09-11-2024 17:38
1.1955 Max
1.1953 Min
Ansys
2024 R
STUDENT


A: Static Structural
Total Deformation 2
Type: Total Deformation
Unit: in
Time: 1 s
09-11-2024 17:38
0.0064931 Max
0.0057716
0.0050502
0.0043287
0.0036073
0.0028858
0.0021644
0.0014429
0.00072145
0 Min
Ansys
2024 R
STUDENT


A: Static Structural
Z Axis - Normal Stress - End Time
Type: Normal Stress(Z Axis)
Unit: psi
Global Coordinate System
Time: 1 s
09-11-2024 17:37
5.6599e5 Max
4.6297e5
3.5995e5
2.5693e5
1.5392e5
50897
-52121
-1.5514e5
-2.5816e5
-3.6118e5 Min
Ansys
2024 R
STUDENT





Properties of Outline Row 4: Aluminum Alloy

	A	B	C
1	Property	Value	Unit
2	Density	0.10007	lb in^-3
3	Isotropic Secant Coefficient of Thermal Expansion		
5	Isotropic Elasticity		
6	Derive from	Young's Modulus and Poisson's...	
7	Young's Modulus	1.0298E+07	psi
8	Poisson's Ratio	0.33	
9	Bulk Modulus	1.0096E+07	psi
10	Shear Modulus	3.8713E+06	psi
11	S-N Curve	Tabular	
15	Tensile Yield Strength	40611	psi
16	Compressive Yield Strength	40611	psi
17	Tensile Ultimate Strength	44962	psi
18	Compressive Ultimate Strength	0	psi

EXAMPLE 2

thickness = 1inch

Length = 12 inch

height => 2inch

youngs modules = 1.029×10^7

possion Ratio = 0.33

$I \Rightarrow \frac{1}{12} h^3 \times b = \frac{1}{12} \times (2)^3 = \frac{1}{12} \times 8 \times 1 = 0.667$

$M_a = P \times L \Rightarrow 10000 \times (12-0.5) \Rightarrow 10000 \times 11.5$

$\Rightarrow 115000$ psi

$c = \frac{1}{2} h \Rightarrow \frac{1}{2} \times 2 = 1$

$\sigma_{nominal} \Rightarrow \frac{MC}{I} \Rightarrow \frac{115000 \times 1}{0.667} = 1.724 \times 10^5$

Kt value from table =

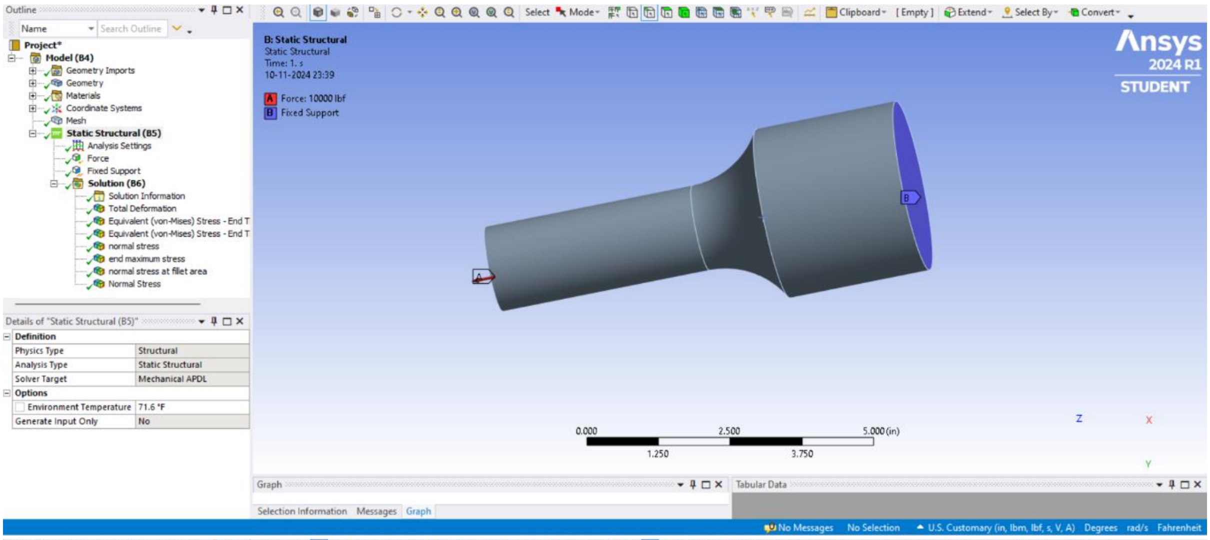
$\sigma_{max} \Rightarrow Kt \times \sigma_{nomial}$

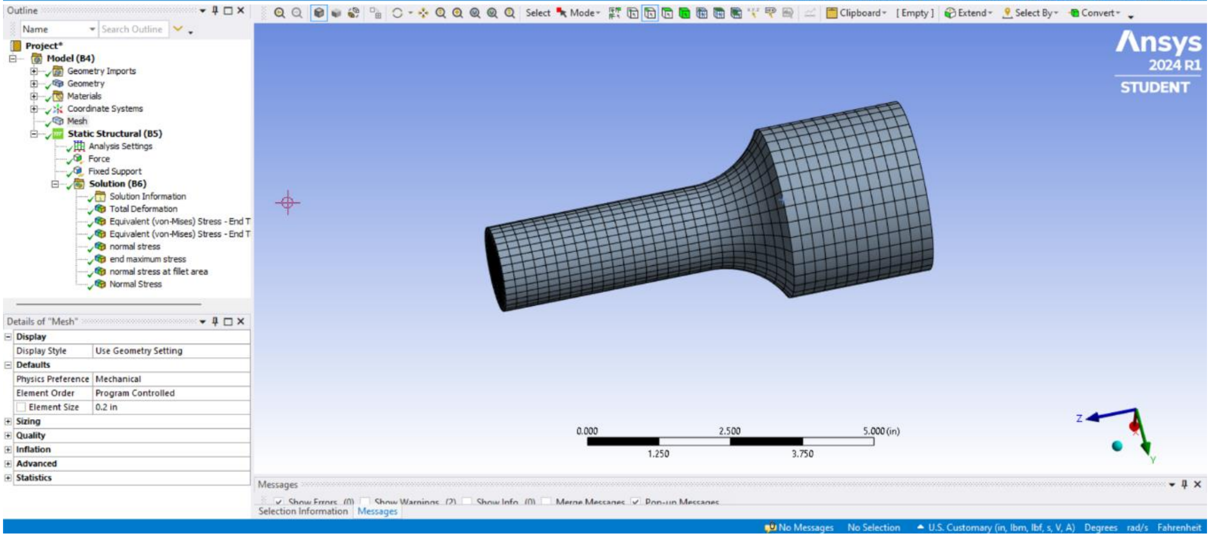
$\Rightarrow 2.5 \times 1.724 \times 10^5 \Rightarrow 3.442 \times 10^5$ psi

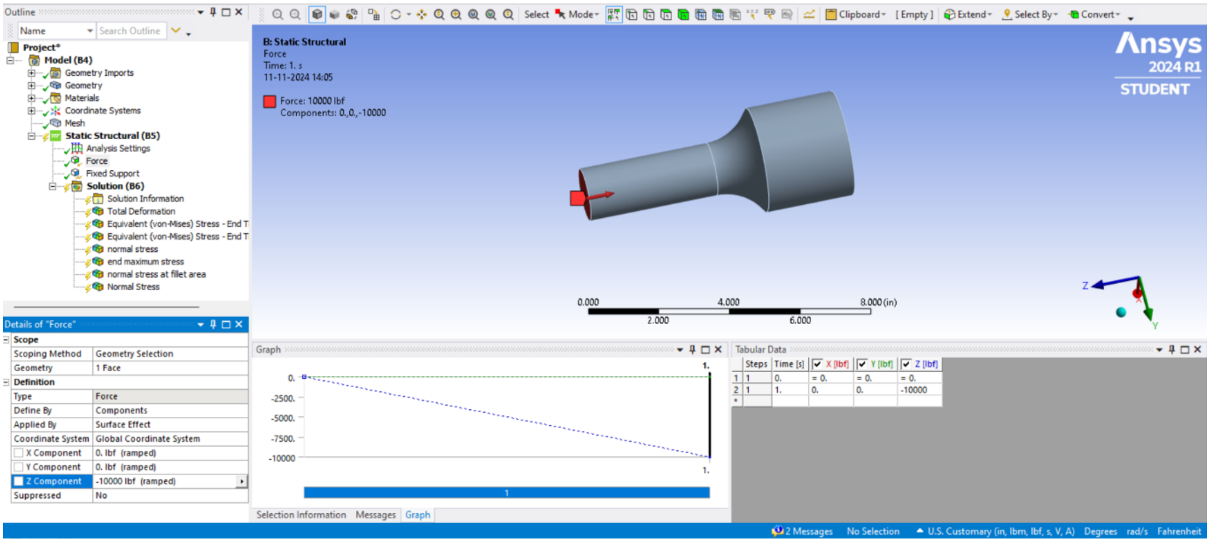
$y = \frac{P \times L^3}{3 \times E \times I} \Rightarrow \frac{10000 \times (11.5)^3}{3 \times 1.029 \times 10^7 \times 0.667}$

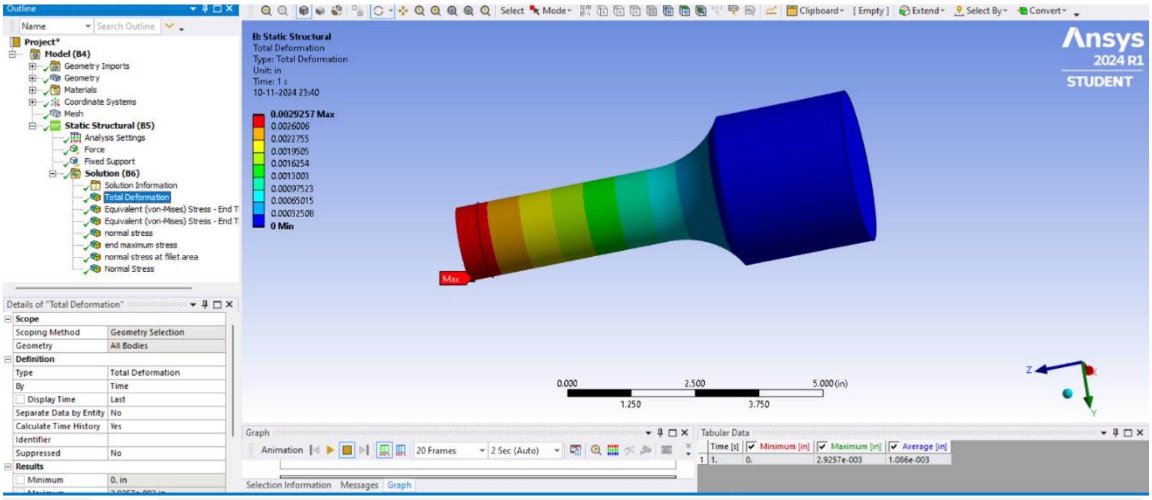
$\Rightarrow 0.00624972.$

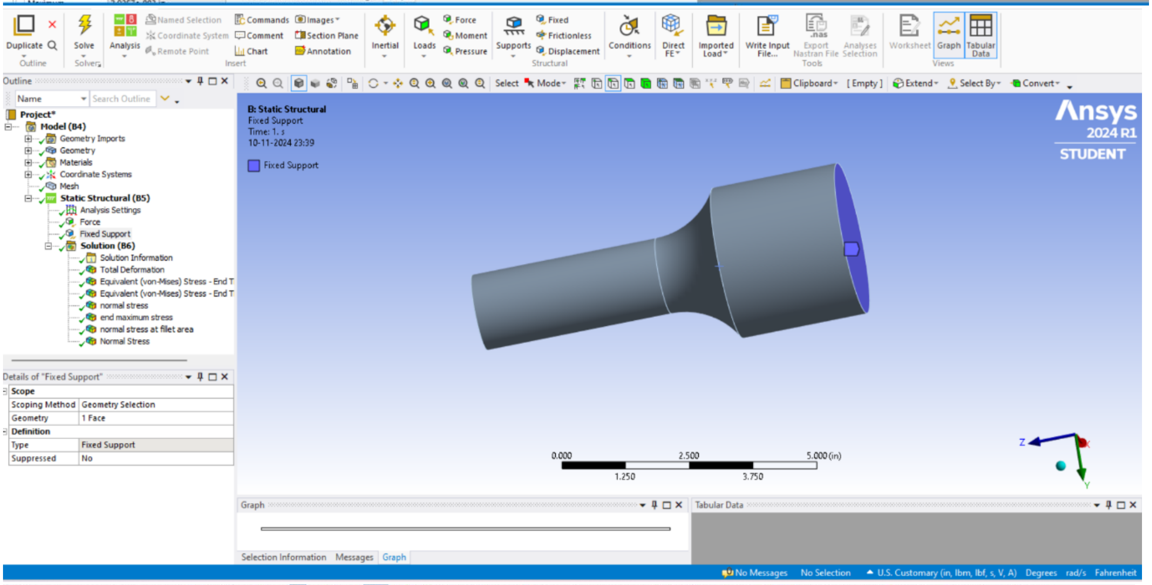
TASK3

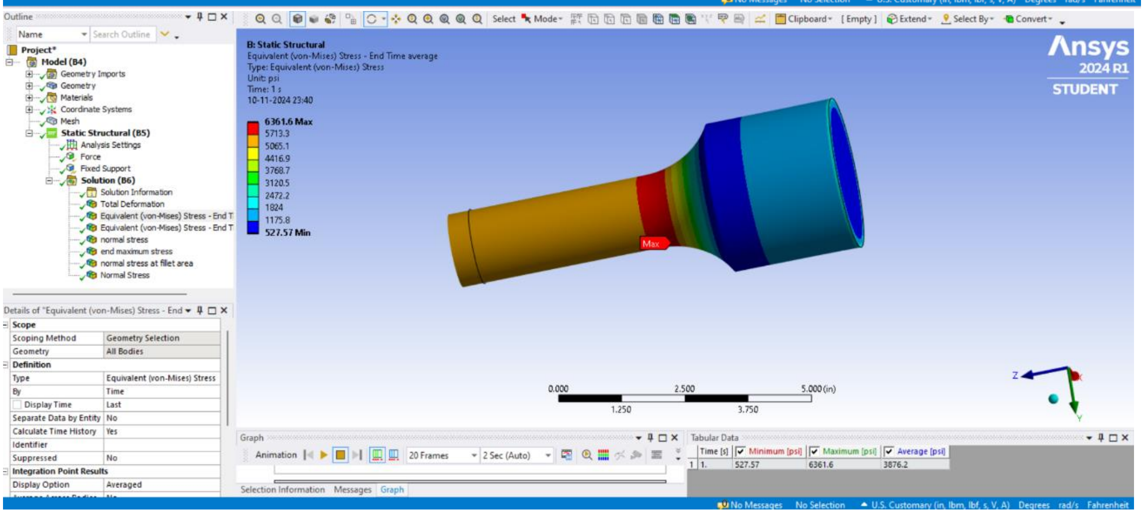

B: Static Structural
Static Structural
Time: 1. s
10-11-2024 23:39
Force: 10000 lbf
Fixed Support
Ansys
2024 R1
STUDENT
Details of "Static Structural (B5)"
Definition
Physics Type | Structural
Analysis Type | Static Structural
Solver Target | Mechanical APDL
Options
Environment Temperature | 71.6 °F
Generate Input Only | No
0.000 2.500 5.000 (in)
1.250 3.750

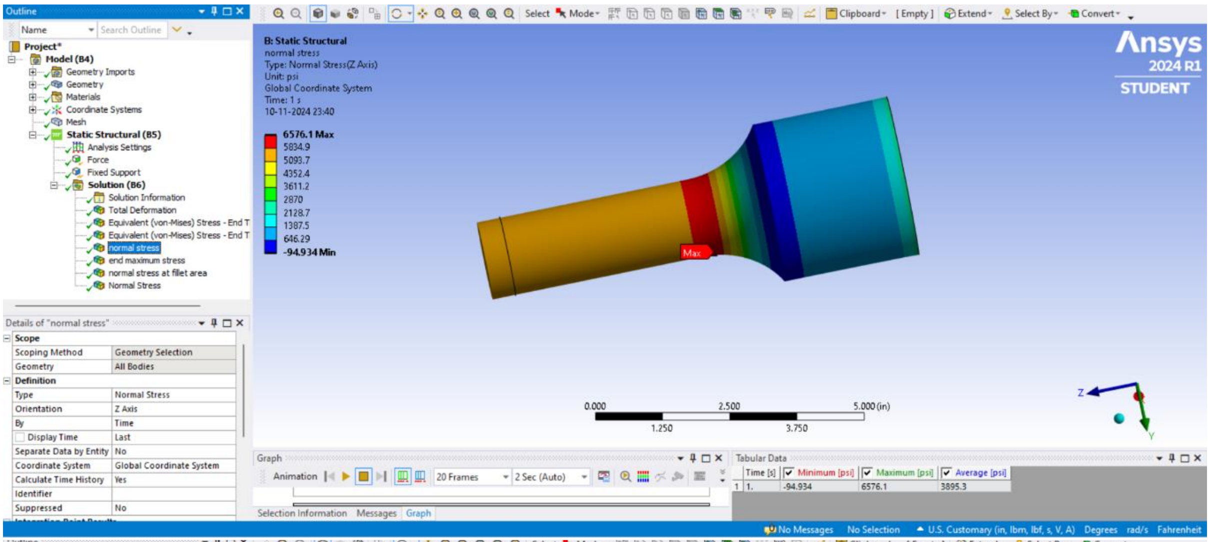

Ansys
2024 R1
STUDENT
Details of "Mesh"
Display
Display Style | Use Geometry Setting
Defaults
Physics Preference | Mechanical
Element Order | Program Controlled
Element Size | 0.2 in
Sizing
Quality
Inflation
Advanced
Statistics
0.000 2.500 5.000 (in)
1.250 3.750

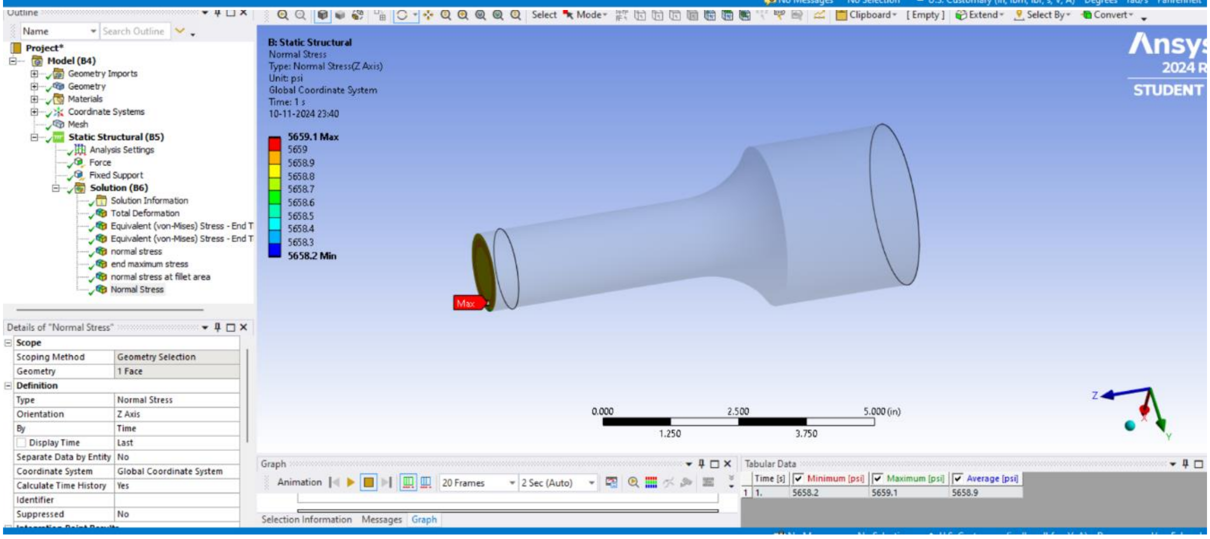

B: Static Structural
Force
Time: 1. s
11-11-2024 14:05
Force: 10000 lbf
Components: 0.,0.,-10000
Ansys
2024 R1
STUDENT
Details of "Force"
Scope
Scoping Method | Geometry Selection
Geometry | 1 Face
Definition
Type | Force
Define By | Components
Applied By | Surface Effect
Coordinate System | Global Coordinate System
X Component | 0. lbf (ramped)
Y Component | 0. lbf (ramped)
Z Component | -10000 lbf (ramped)
Suppressed | No
0.000 4.000 8.000 (in)
2.000 6.000

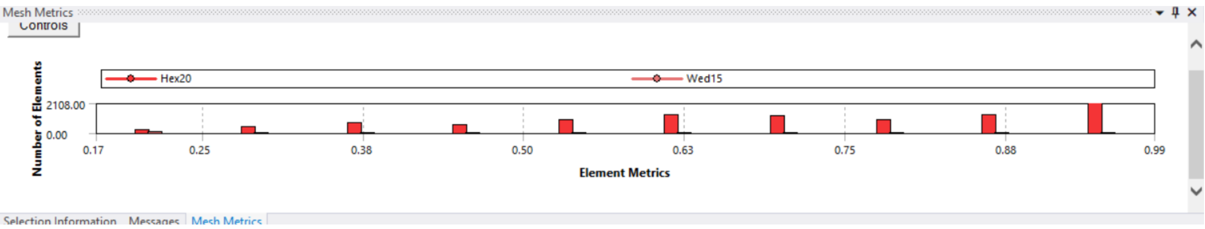

B: Static Structural
Total Deformation
Type: Total Deformation
Unit: in
Time: 1 s
10-11-2024 23:40
0.0029257 Max
0.0026006
0.0022755
0.0019505
0.0016254
0.0013003
0.00097523
0.00065015
0.00032508
0 Min
Max
Ansys
2024 R1
STUDENT
Details of "Total Deformation"
Scoping Method
Geometry Selection
Geometry
All Bodies
Type
Total Deformation
Display Time
Last
Minimum
0. in
Tabular Data
2.9257e-003
1.086e-003


B: Static Structural
Fixed Support
Time: 1. s
10-11-2024 23:39
Fixed Support
Ansys
2024 R1
STUDENT
Details of "Fixed Support"
Scoping Method
Geometry Selection
Geometry
1 Face
Type
Fixed Support
Suppressed
No


B: Static Structural
Equivalent (von-Mises) Stress - End Time average
Type: Equivalent (von-Mises) Stress
Unit: psi
Time: 1 s
10-11-2024 23:40
6361.6 Max
5713.3
5065.1
4416.9
3768.7
3120.5
2472.2
1824
1175.8
527.57 Min
Max
Ansys
2024 R1
STUDENT
Tabular Data
527.57
6361.6
3876.2







Properties of Outline Row 4: Aluminum Alloy

	A	B	C
1	Property	Value	Unit
2	Density	0.10007	lb in^-3
3	Isotropic Secant Coefficient of Thermal Expansion		
5	Isotropic Elasticity		
6	Derive from	Young's Modulus and Poisson's...	
7	Young's Modulus	1.0298E+07	psi
8	Poisson's Ratio	0.33	
9	Bulk Modulus	1.0096E+07	psi
10	Shear Modulus	3.8713E+06	psi
11	S-N Curve	Tabular	
15	Tensile Yield Strength	40611	psi
16	Compressive Yield Strength	40611	psi
17	Tensile Ultimate Strength	44962	psi
18	Compressive Ultimate Strength	0	psi

EXAMPLE 1

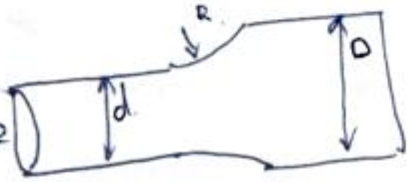
Task-3.

$D = 1.5$ inch

$d = 0.75$ inch

1.029×10^7 youngs module

0.33 possion's radio



$$Area = \frac{\pi d^2}{4} = \frac{\pi (0.75)^2}{4} = 0.4418 \text{ in}^2$$

nominal stress $\sigma_{nominal}$

$$\sigma_{nominal} = \frac{F}{A} = \frac{10000 \text{ lbs}}{0.4418} = 22640 \text{ psi}$$

Determine the stress concentration factor (K_t)

$$\frac{D}{d} = \frac{1.5}{0.75} = 2.$$

K_t value from table for $D/d = 2$ is

$K_t = 2.5$

calculating maximum stress (σ_{max}) at the fillet

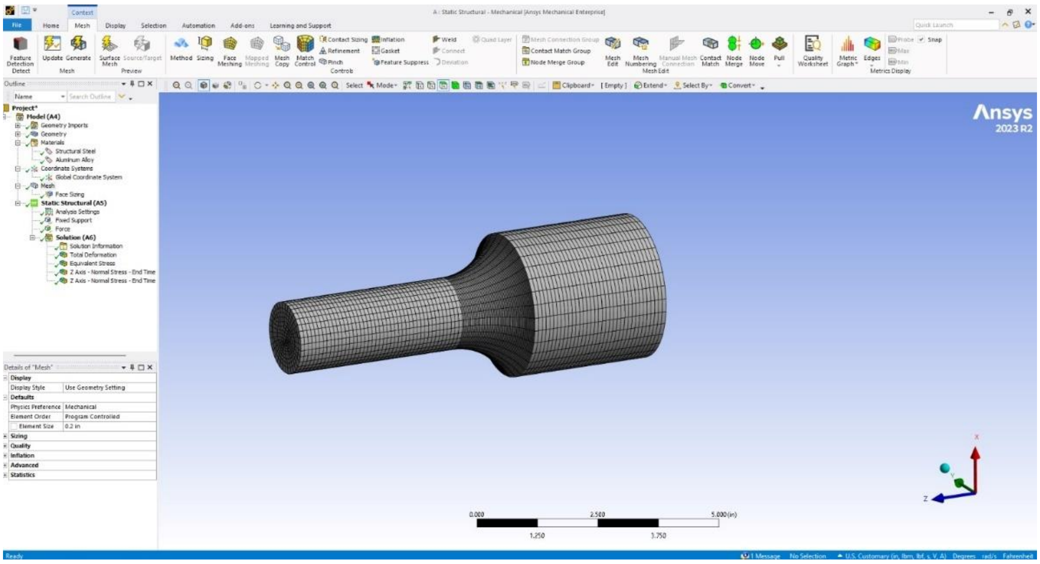
The maximum stress near the shoulder fillet is given as

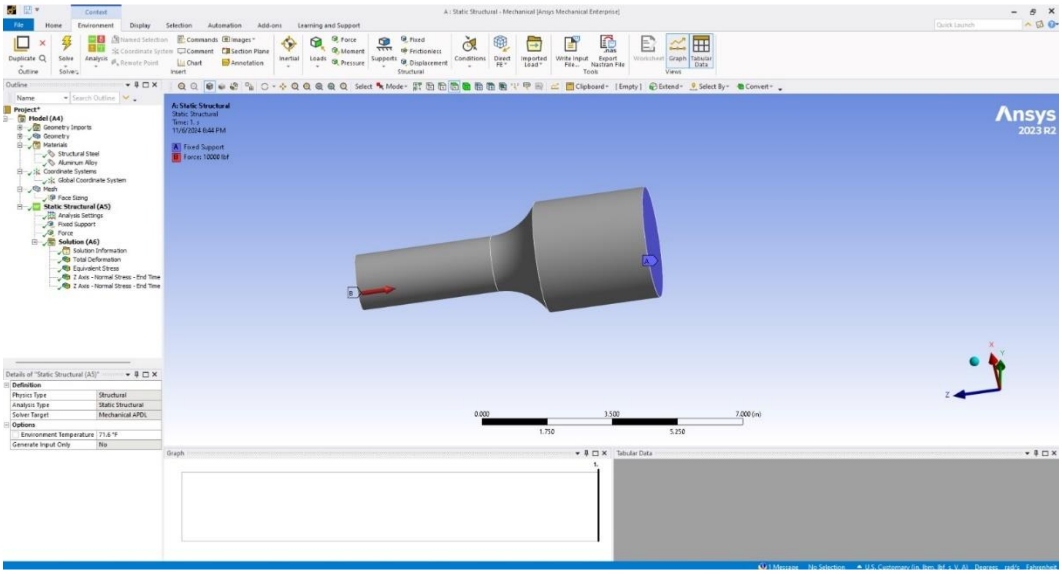
$$\sigma_{max} = K_t \times \sigma_{nominal}$$

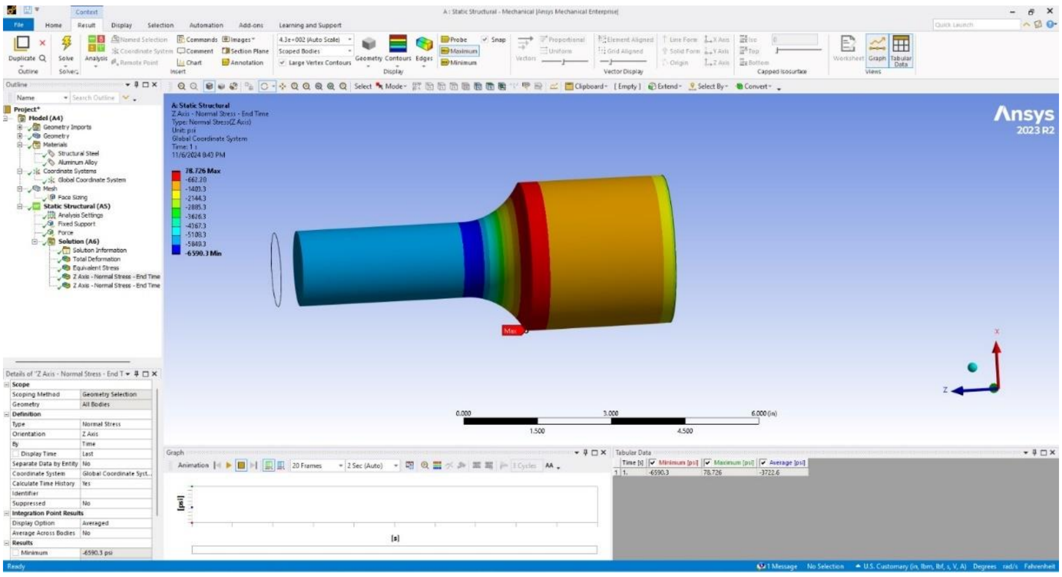
$$= 2.5 \times 22640.$$

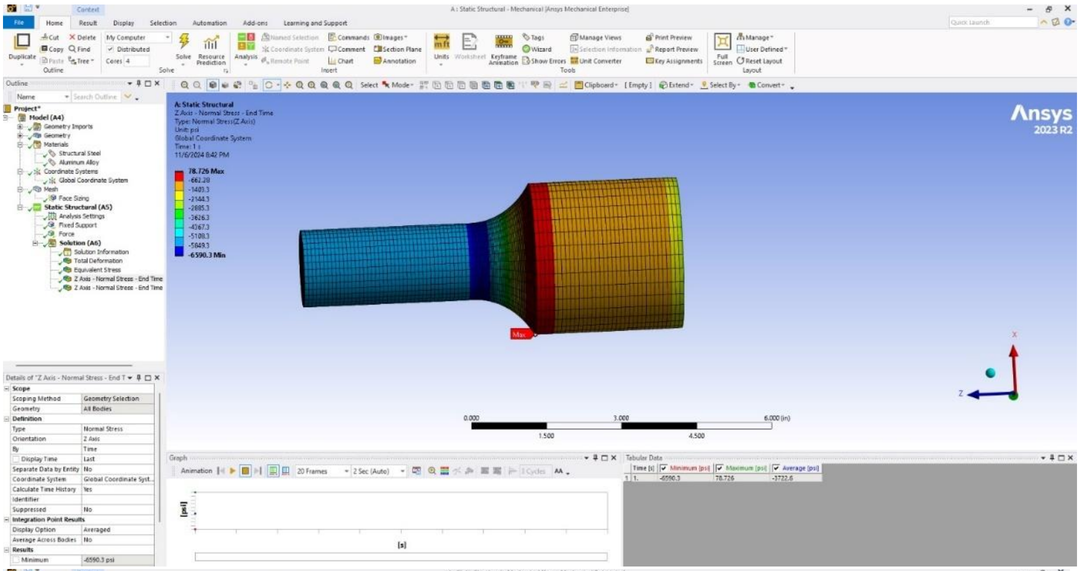
$$\Rightarrow 5[illegible]4100 \text{ psi}$$

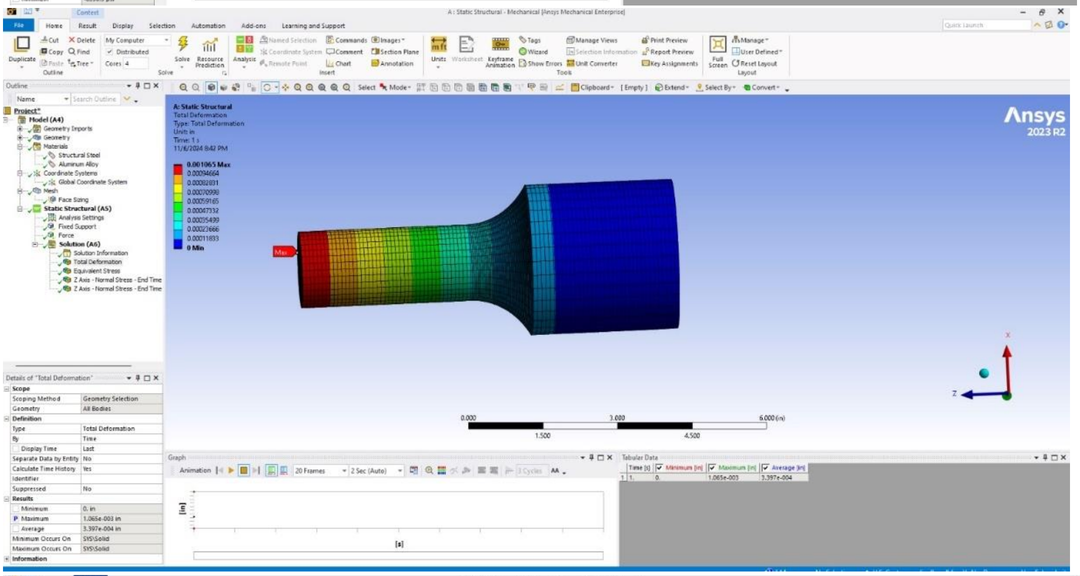
EXAMPLE 2

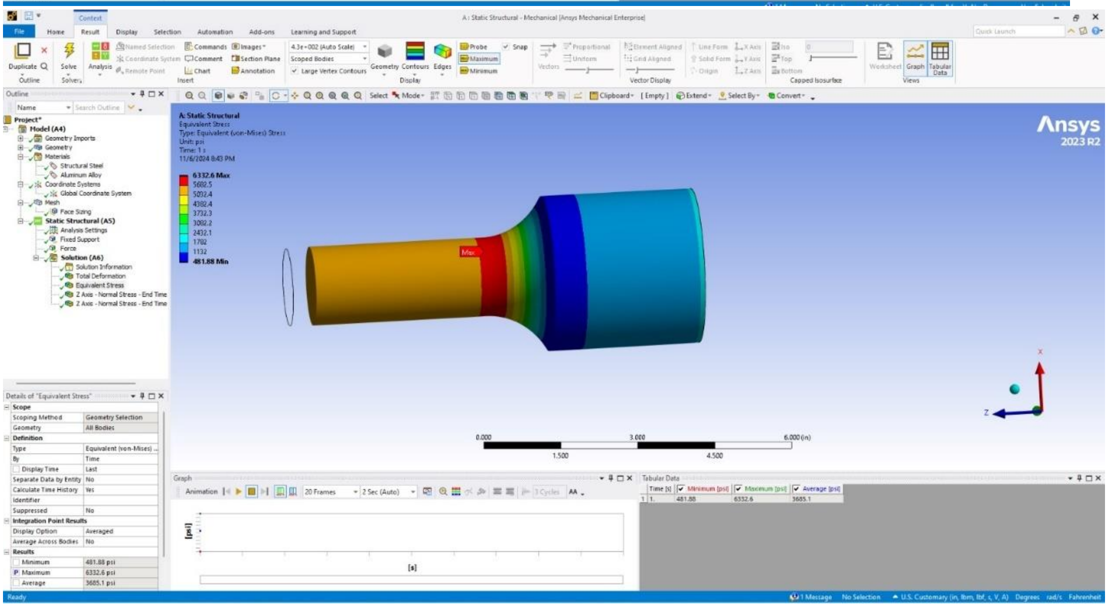


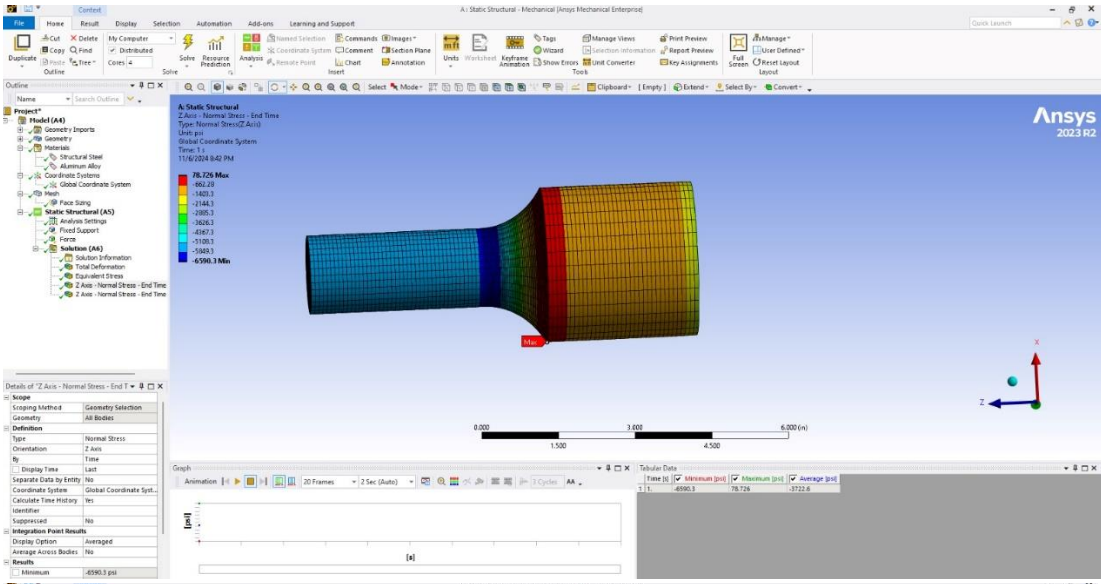


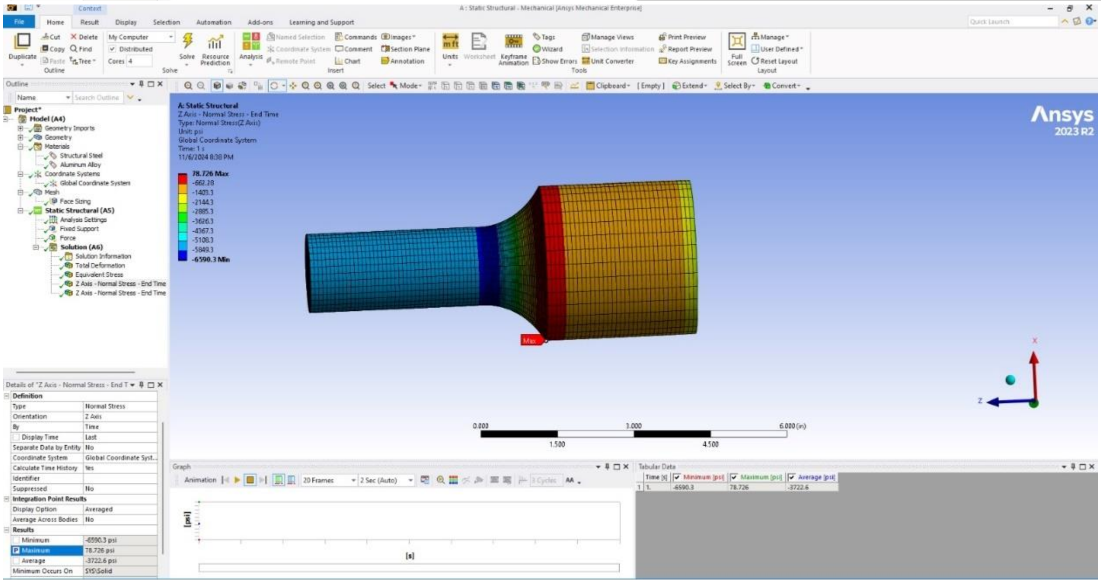


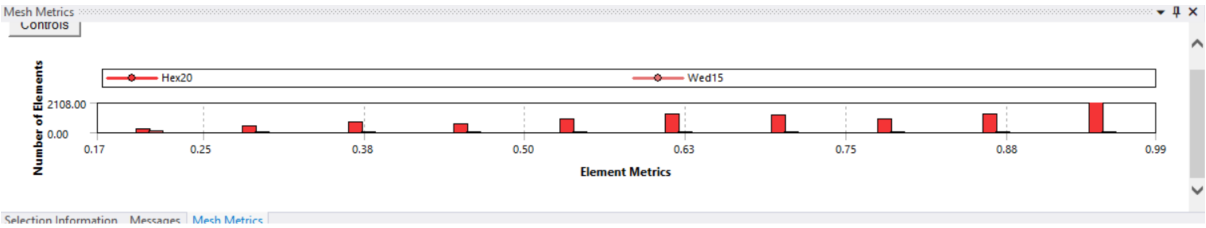

A: Static Structural
Z Axis - Normal Stress - End Time
Type: Normal Stress(Z Axis)
Unit: psi
Global Coordinate System
Time: 1 s
78.726 Max
-6590.3 Min
Ansys
2023 R2


A: Static Structural
Total Deformation
Type: Total Deformation
Unit: in
Time: 1 s
0.001065 Max
0 Min
Ansys
2023 R2


A: Static Structural
Equivalent Stress
Type: Equivalent (von-Mises) Stress
Unit: psi
Time: 1 s
6332.6 Max
481.88 Min
Ansys
2023 R2







Properties of Outline Row 4: Aluminum Alloy

	A	B	C
1	Property	Value	Unit
2	Density	0.10007	lb in^-3
3	Isotropic Secant Coefficient of Thermal Expansion		
5	Isotropic Elasticity		
6	Derive from	Young's Modulus and Poisson's...	
7	Young's Modulus	1.0298E+07	psi
8	Poisson's Ratio	0.33	
9	Bulk Modulus	1.0096E+07	psi
10	Shear Modulus	3.8713E+06	psi
11	S-N Curve	Tabular	
15	Tensile Yield Strength	40611	psi
16	Compressive Yield Strength	40611	psi
17	Tensile Ultimate Strength	44962	psi
18	Compressive Ultimate Strength	0	psi

EXAMPLE -2

Small diameter (d) = 0.75 inches

Larger diameter (D) = 2 inches

Applied load = 10000 lbs.

material - Aluminium.

youngs modules $E = 1.029 \times 10^{7}$ psi

possion Ratio = 0.33

crossectional Area (A)

$$A = \frac{\pi d^2}{4} = \frac{\pi (0.75)^2}{4} = 0.4418 \, in^2$$

Norminal stress

$$\sigma_{nominal} = \frac{F}{A} = \frac{10000 \, lbs}{0.4418} = 22{,}640 \, psi$$

stress concentration factor.

Diameter Ratio $\frac{D}{d} = \frac{2}{0.75} = 2.67$.

from Table. $D/d = 2.67$ the Kt value is 2.7.

maximum stress $\sigma_{max} = K_t \times \sigma_{nominal}$.

$$\Rightarrow 2.7 \times 22640$$

$$= 61128 \, psi$$