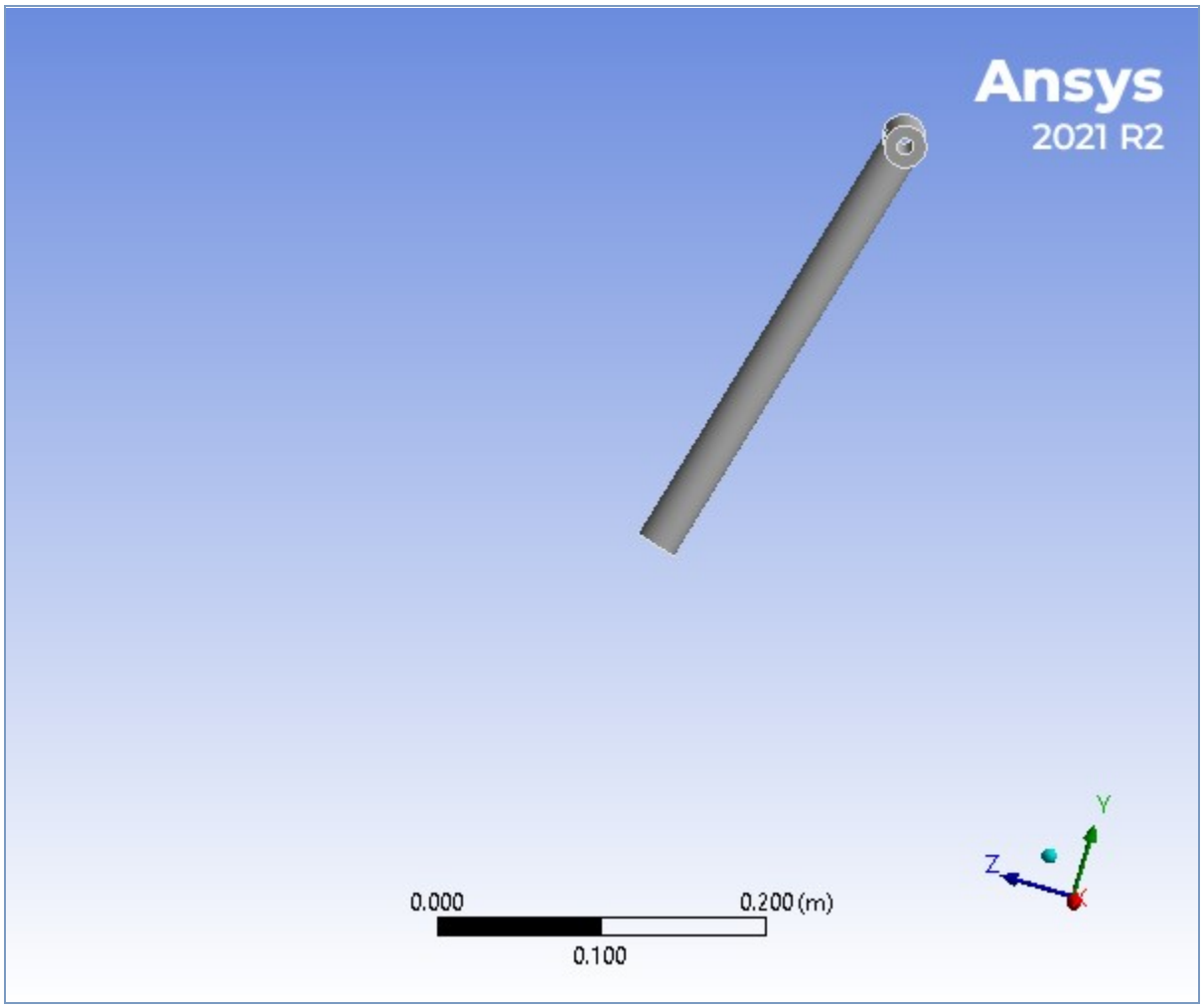
Project*

First Saved	Wednesday, November 16, 2022
Last Saved	Wednesday, November 16, 2022
Product Version	2021 R2
Save Project Before Solution	No
Save Project After Solution	No



Contents

Report Not Finalized

Not all objects described below are in a finalized state. As a result, data may be incomplete, obsolete or in error. View first state problem. To finalize this report, edit objects as needed and solve the analyses.

Units

TABLE 1

Unit System	Metric (m, kg, N, s, V, A) Degrees rad/s Celsius
Angle	Degrees
Rotational Velocity	rad/s
Temperature	Celsius

Model (B4)

Geometry

TABLE 2
Model (B4) > Geometry

Object Name	*Geometry*
State	Fully Defined
Definition	
Source	C:\Users\Arjun\hyderabad.bits-pilani.ac.in\Vulcan 2022-23 - Suspension and Steering\Simulations\Sims\control arms sims\H arms lower_2_files\dp0\SYS-1\DM\SYS-1.scdoc
Type	SpaceClaim
Length Unit	Meters
Element Control	Program Controlled

Display Style	Body Color
Bounding Box	
Length X	7.e-002 m
Length Y	0.29367 m
Length Z	9.9177e-002 m
Properties	
Volume	5.1339e-005 m³
Mass	0.40301 kg
Scale Factor Value	1.
Statistics	
Bodies	1
Active Bodies	1
Nodes	8773
Elements	4350
Mesh Metric	None
Update Options	
Assign Default Material	No
Basic Geometry Options	
Solid Bodies	Yes
Surface Bodies	Yes
Line Bodies	Yes
Parameters	Independent
Parameter Key	
Attributes	Yes
Attribute Key	
Named Selections	Yes
Named Selection Key	
Material Properties	Yes
Advanced Geometry Options	
Use Associativity	Yes
Coordinate Systems	Yes
Coordinate System Key	
Reader Mode Saves Updated File	No
Use Instances	Yes
Smart CAD Update	Yes
Compare Parts On Update	No
Analysis Type	3-D
Mixed Import Resolution	None
Import Facet Quality	Source
Clean Bodies On Import	No
Stitch Surfaces On Import	None
Decompose Disjoint Geometry	Yes
Enclosure and Symmetry Processing	Yes

TABLE 3

Model (B4) > Geometry > Parts

Object Name	*SYS-1\Solid*
State	Meshed
Graphics Properties	
Visible	Yes
Transparency	1
Definition	
Suppressed	No
Stiffness Behavior	Flexible
Coordinate System	Default Coordinate System
Reference Temperature	By Environment
Treatment	None
Material	
Assignment	AISI 4130
Nonlinear Effects	Yes
Thermal Strain Effects	Yes
Bounding Box	
Length X	7.e-002 m
Length Y	0.29367 m
Length Z	9.9177e-002 m
Properties	
Volume	5.1339e-005 m³
Mass	0.40301 kg
Centroid X	-7.7196e-003 m
Centroid Y	0.32297 m
Centroid Z	-0.17296 m
Moment of Inertia Ip1	3.2562e-003 kg·m²
Moment of Inertia Ip2	1.3137e-004 kg·m²
Moment of Inertia Ip3	3.3408e-003 kg·m²
Statistics	
Nodes	8773
Elements	4350
Mesh Metric	None
CAD Attributes	
PartTolerance:	0.00000001
Color:143.149.175	

TABLE 4
Model (B4) > Materials

Object Name	*Materials*
State	Fully Defined
Statistics	
Materials	1
Material Assignments	0

Coordinate Systems

TABLE 5
Model (B4) > Coordinate Systems > Coordinate System

Object Name	*Global Coordinate System*
State	Fully Defined
Definition	
Type	Cartesian

Coordinate System ID	0.
Origin	
Origin X	0. m
Origin Y	0. m
Origin Z	0. m
Directional Vectors	
X Axis Data	[1. 0. 0.]
Y Axis Data	[0. 1. 0.]
Z Axis Data	[0. 0. 1.]

Mesh

TABLE 6
Model (B4) > Mesh

Object Name	*Mesh*
State	Solved
Display	
Display Style	Use Geometry Setting
Defaults	
Physics Preference	Mechanical
Element Order	Program Controlled
Element Size	Default
Sizing	
Use Adaptive Sizing	Yes
Resolution	Default (2)
Mesh Defeaturing	Yes
Defeature Size	Default
Transition	Fast
Span Angle Center	Coarse
Initial Size Seed	Assembly
Bounding Box Diagonal	0.31777 m
Average Surface Area	6.4098e-003 m²
Minimum Edge Length	3.1416e-002 m
Quality	
Check Mesh Quality	Yes, Errors
Error Limits	Aggressive Mechanical
Target Quality	Default (0.050000)
Smoothing	Medium
Mesh Metric	None
Inflation	
Use Automatic Inflation	None
Inflation Option	Smooth Transition
Transition Ratio	0.272
Maximum Layers	5
Growth Rate	1.2
Inflation Algorithm	Pre
View Advanced Options	No
Advanced	
Number of CPUs for Parallel Part Meshing	Program Controlled
Straight Sided Elements	No
Rigid Body Behavior	Dimensionally Reduced
Triangle Surface Mesher	Program Controlled

Topology Checking	Yes
Pinch Tolerance	Please Define
Generate Pinch on Refresh	No
Statistics	
Nodes	8773
Elements	4350

Static Structural (B5)

TABLE 7
Model (B4) > Analysis

Object Name	*Static Structural (B5)*
State	Solved
Definition	
Physics Type	Structural
Analysis Type	Static Structural
Solver Target	Mechanical APDL
Options	
Environment Temperature	22. °C
Generate Input Only	No

TABLE 8
Model (B4) > Static Structural (B5) > Analysis Settings

Object Name	*Analysis Settings*
State	Fully Defined
Step Controls	
Number Of Steps	1.
Current Step Number	1.
Step End Time	1. s
Auto Time Stepping	Program Controlled
Solver Controls	
Solver Type	Program Controlled
Weak Springs	Off
Solver Pivot Checking	Program Controlled
Large Deflection	Off
Inertia Relief	Off
Quasi-Static Solution	Off
Rotordynamics Controls	
Coriolis Effect	Off
Restart Controls	
Generate Restart Points	Program Controlled
Retain Files After Full Solve	No
Combine Restart Files	Program Controlled
Nonlinear Controls	
Newton-Raphson Option	Program Controlled
Force Convergence	Program Controlled

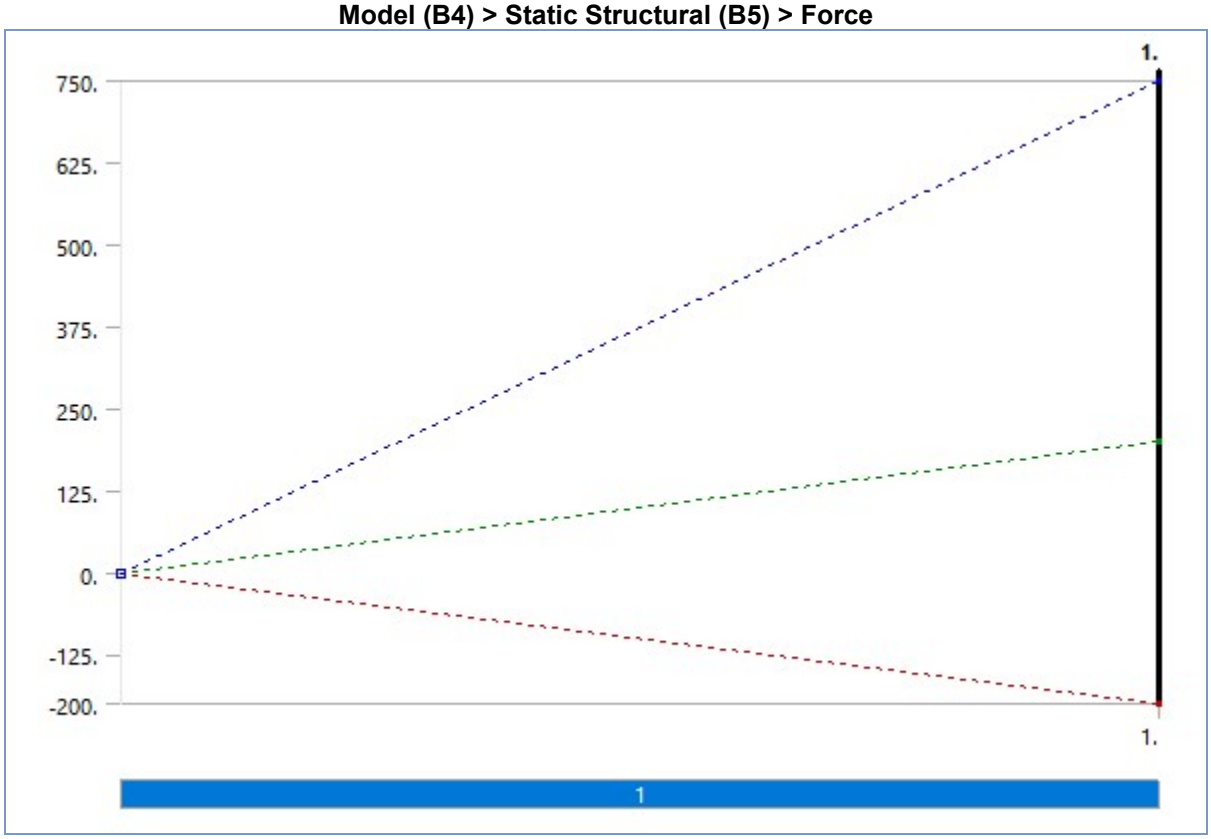
Moment Convergence	Program Controlled
Displacement Convergence	Program Controlled
Rotation Convergence	Program Controlled
Line Search	Program Controlled
Stabilization	Program Controlled
Advanced	
Inverse Option	No
Contact Split (DMP)	Off
Output Controls	
Stress	Yes
Surface Stress	No
Back Stress	No
Strain	Yes
Contact Data	Yes
Nonlinear Data	No
Nodal Forces	No
Volume and Energy	Yes
Euler Angles	Yes
General Miscellaneous	No
Contact Miscellaneous	No
Store Results At	All Time Points
Result File Compression	Program Controlled
Analysis Data Management	
Solver Files Directory	C:\Users\Arjun\hyderabad.bits-pilani.ac.in\Vulcan 2022-23 - Suspension and Steering\Simulations\Sims\control arms sims\H arms lower_2_files\dp0\SYS-1\MECH\
Future Analysis	None
Scratch Solver Files Directory	
Save MAPDL db	No
Contact Summary	Program Controlled
Delete Unneeded Files	Yes
Nonlinear Solution	No
Solver Units	Active System
Solver Unit System	mks

TABLE 9
Model (B4) > Static Structural (B5) > Loads

Object Name	*Cylindrical Support*	*Force*
State	Fully Defined	
Scope		
Scoping Method	Geometry Selection	
Geometry	1 Face	
Definition		
Type	Cylindrical Support	Force
Radial	Fixed	
Axial	Fixed	
Tangential	Fixed	

Suppressed	No	
Define By		Components
Applied By		Surface Effect
Coordinate System		Global Coordinate System
X Component		-200. N (ramped)
Y Component		200. N (ramped)
Z Component		750. N (ramped)

FIGURE 1
Model (B4) > Static Structural (B5) > Force



Solution (B6)

TABLE 10
Model (B4) > Static Structural (B5) > Solution

Object Name	*Solution (B6)*
State	Solve Failed
Adaptive Mesh Refinement	
Max Refinement Loops	1.
Refinement Depth	2.
Information	
Status	Solve Required, Partial Results Available
MAPDL Elapsed Time	4. s
MAPDL Memory Used	161. MB
MAPDL Result File Size	3.0625 MB
Post Processing	
Beam Section Results	No
On Demand Stress/Strain	No

TABLE 11
Model (B4) > Static Structural (B5) > Solution (B6) > Solution Information

Object Name	*Solution Information*
State	Solve Failed
Solution Information	
Solution Output	Solver Output
Newton-Raphson Residuals	0
Identify Element Violations	0
Update Interval	2.5 s
Display Points	All
FE Connection Visibility	
Activate Visibility	Yes
Display	All FE Connectors
Draw Connections Attached To	All Nodes
Line Color	Connection Type
Visible on Results	No
Line Thickness	Single
Display Type	Lines

TABLE 12
Model (B4) > Static Structural (B5) > Solution (B6) > Results

Object Name	*Total Deformation*	*Equivalent Stress*
State	Solved	
Scope		
Scoping Method	Geometry Selection	
Geometry	All Bodies	
Definition		
Type	Total Deformation	Equivalent (von-Mises) Stress
By	Time	
Display Time	Last	
Calculate Time History	Yes	
Identifier		
Suppressed	No	
Results		
Minimum	0. m	7.4854e+005 Pa
Maximum	4.7296e-003 m	4.5238e+008 Pa
Average	1.6799e-003 m	1.4324e+008 Pa
Minimum Occurs On	SYS-1\Solid	
Maximum Occurs On	SYS-1\Solid	
Information		
Time	1. s	
Load Step	1	
Substep	1	
Iteration Number	1	
Integration Point Results		
Display Option		Averaged
Average Across Bodies		No

FIGURE 2
Model (B4) > Static Structural (B5) > Solution (B6) > Total Deformation

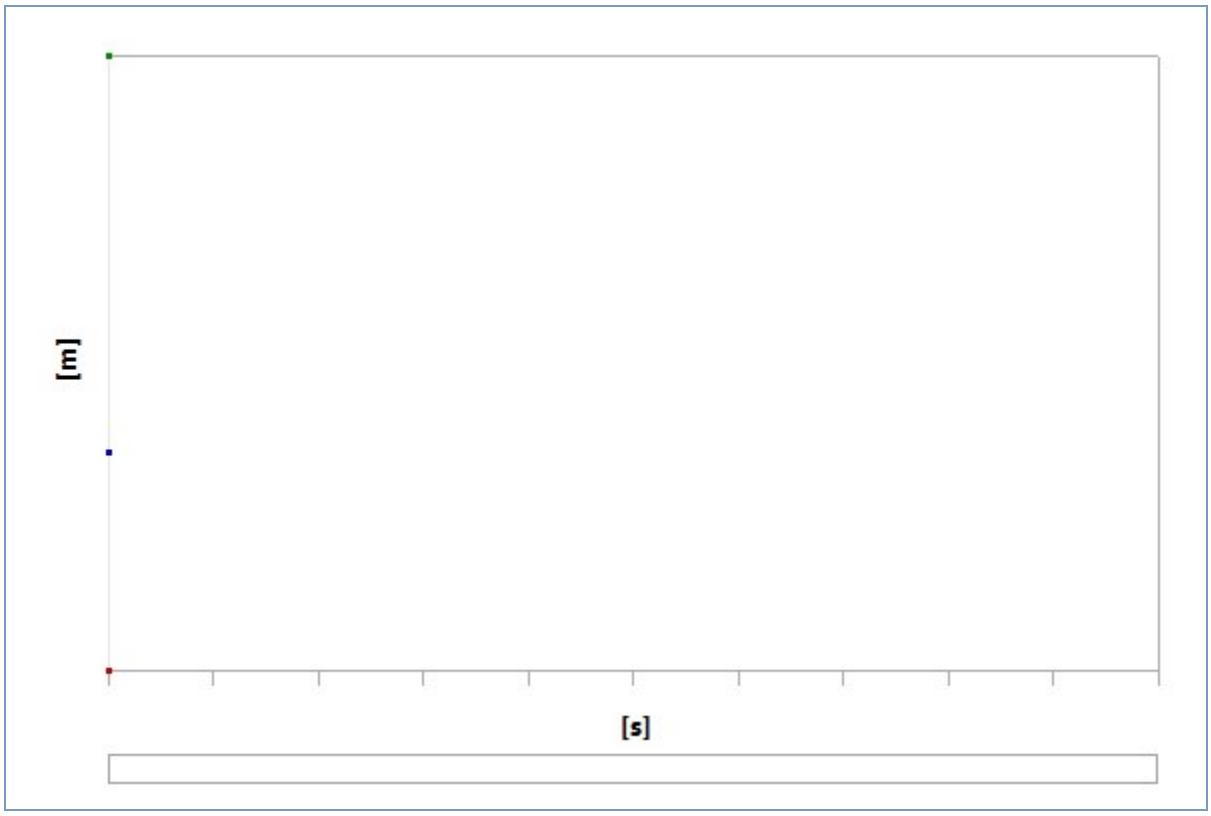


TABLE 13
Model (B4) > Static Structural (B5) > Solution (B6) > Total Deformation

Time [s]	Minimum [m]	Maximum [m]	Average [m]
1.	0.	4.7296e-003	1.6799e-003

FIGURE 3
Model (B4) > Static Structural (B5) > Solution (B6) > Total Deformation > Figure

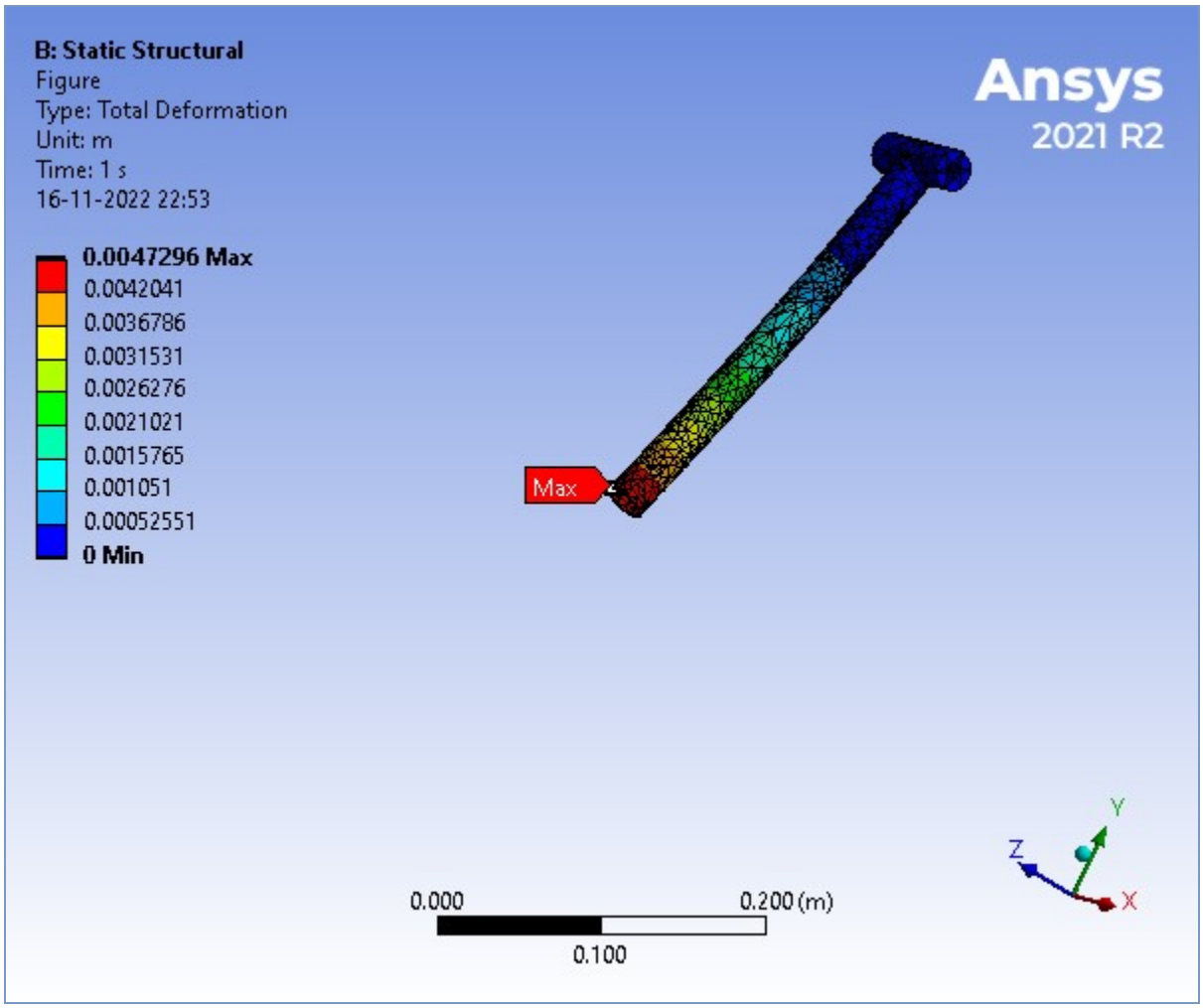


FIGURE 4
Model (B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress

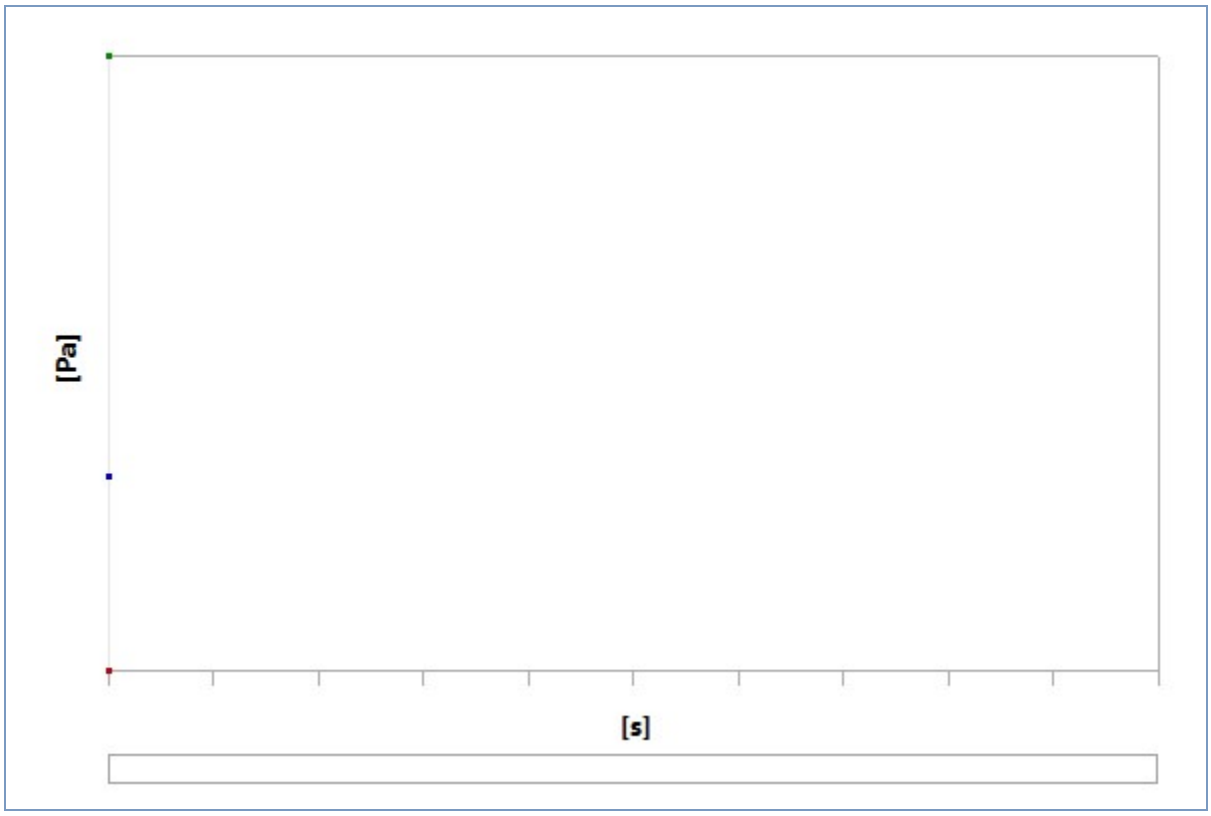


TABLE 14
Model (B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress

Time [s]	Minimum [Pa]	Maximum [Pa]	Average [Pa]
1.	7.4854e+005	4.5238e+008	1.4324e+008

FIGURE 5
Model (B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress > Figure

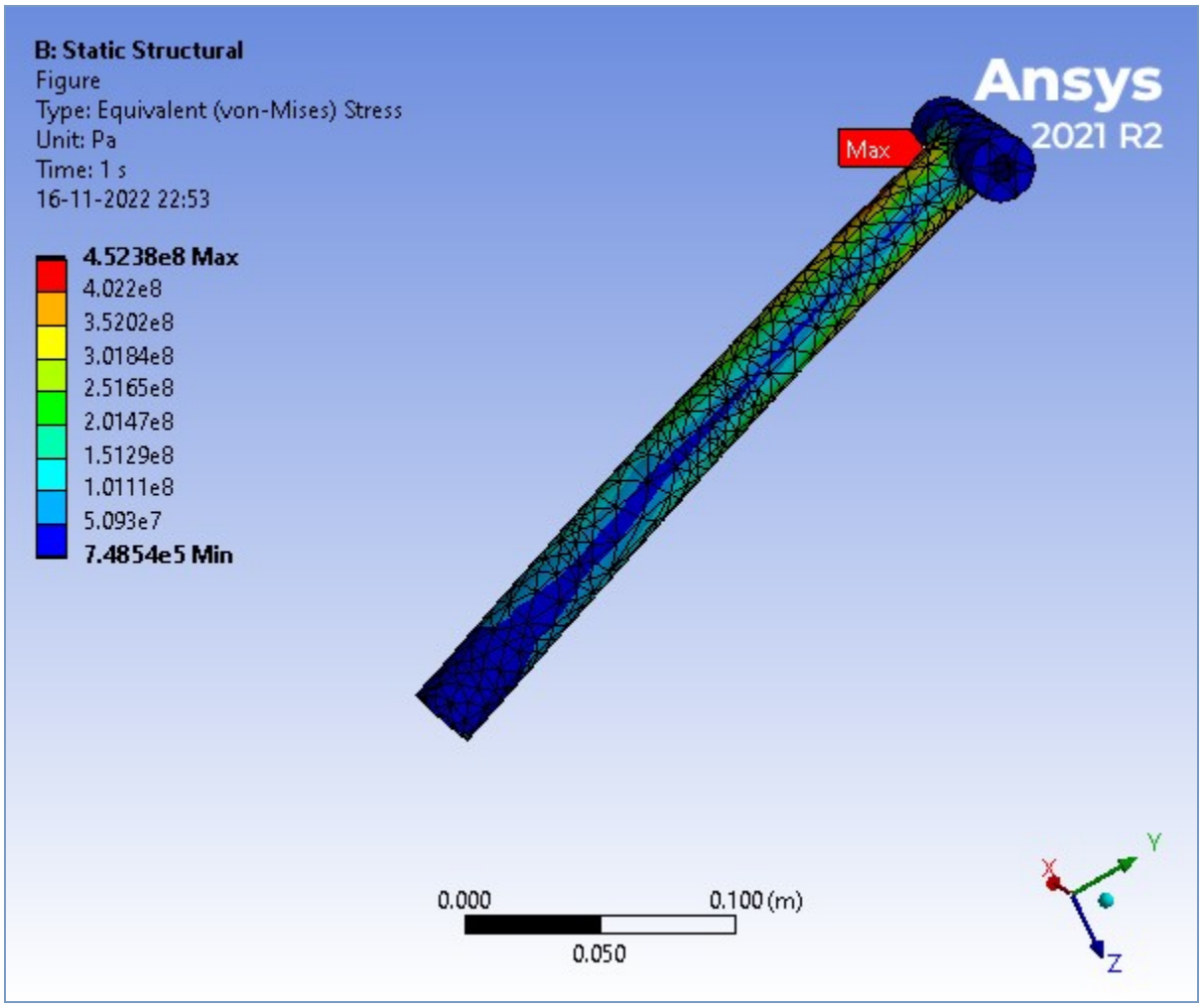


TABLE 15
Model (B4) > Static Structural (B5) > Solution (B6) > Stress Safety Tools

Object Name	*Stress Tool*
State	Solved
Definition	
Theory	Max Equivalent Stress
Stress Limit Type	Tensile Yield Per Material

TABLE 16
Model (B4) > Static Structural (B5) > Solution (B6) > Stress Tool > Results

Object Name	*Safety Factor*
State	Solved
Scope	
Scoping Method	Geometry Selection
Geometry	All Bodies
Definition	
Type	Safety Factor
By	Time
Display Time	Last
Calculate Time History	Yes
Identifier	
Suppressed	No
Integration Point Results	

Display Option	Averaged
Average Across Bodies	No
Results	
Minimum	1.0168
Minimum Occurs On	SYS-1\Solid
Information	
Time	1. s
Load Step	1
Substep	1
Iteration Number	1

FIGURE 6
Model (B4) > Static Structural (B5) > Solution (B6) > Stress Tool > Safety Factor

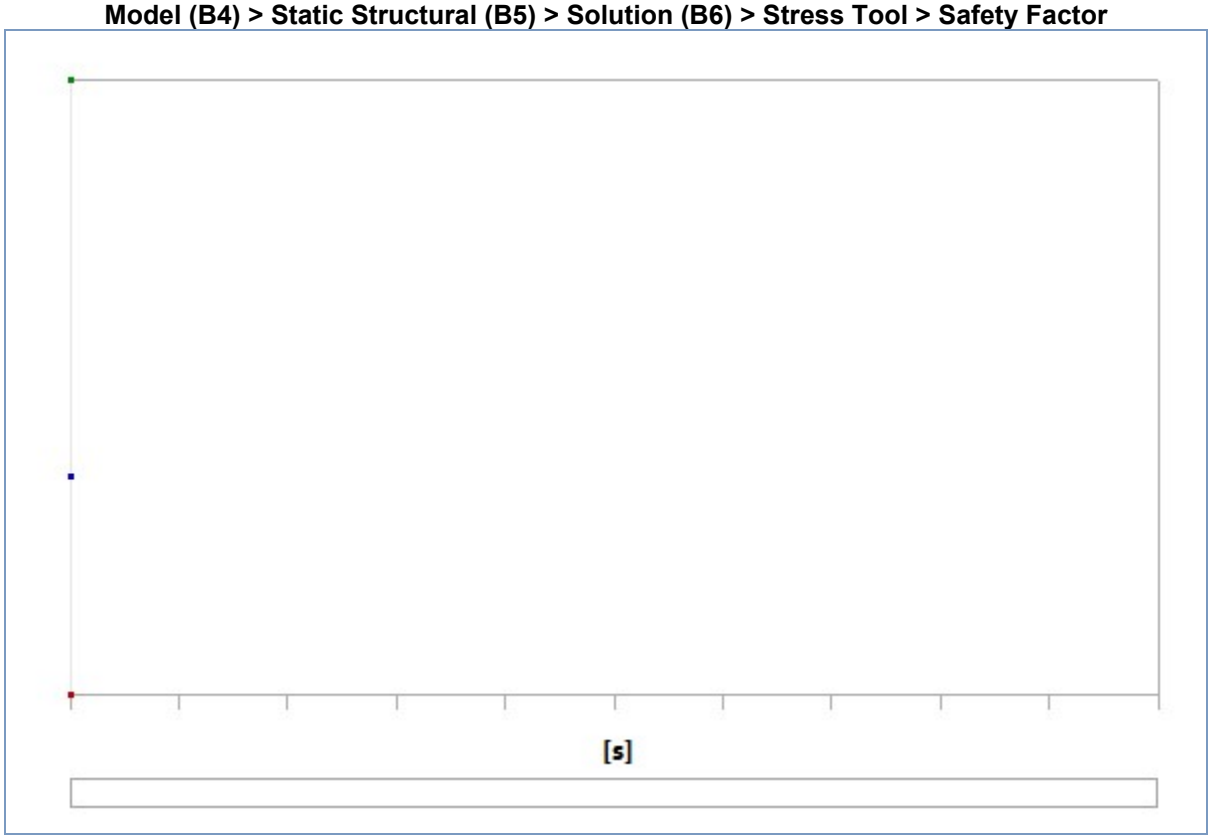
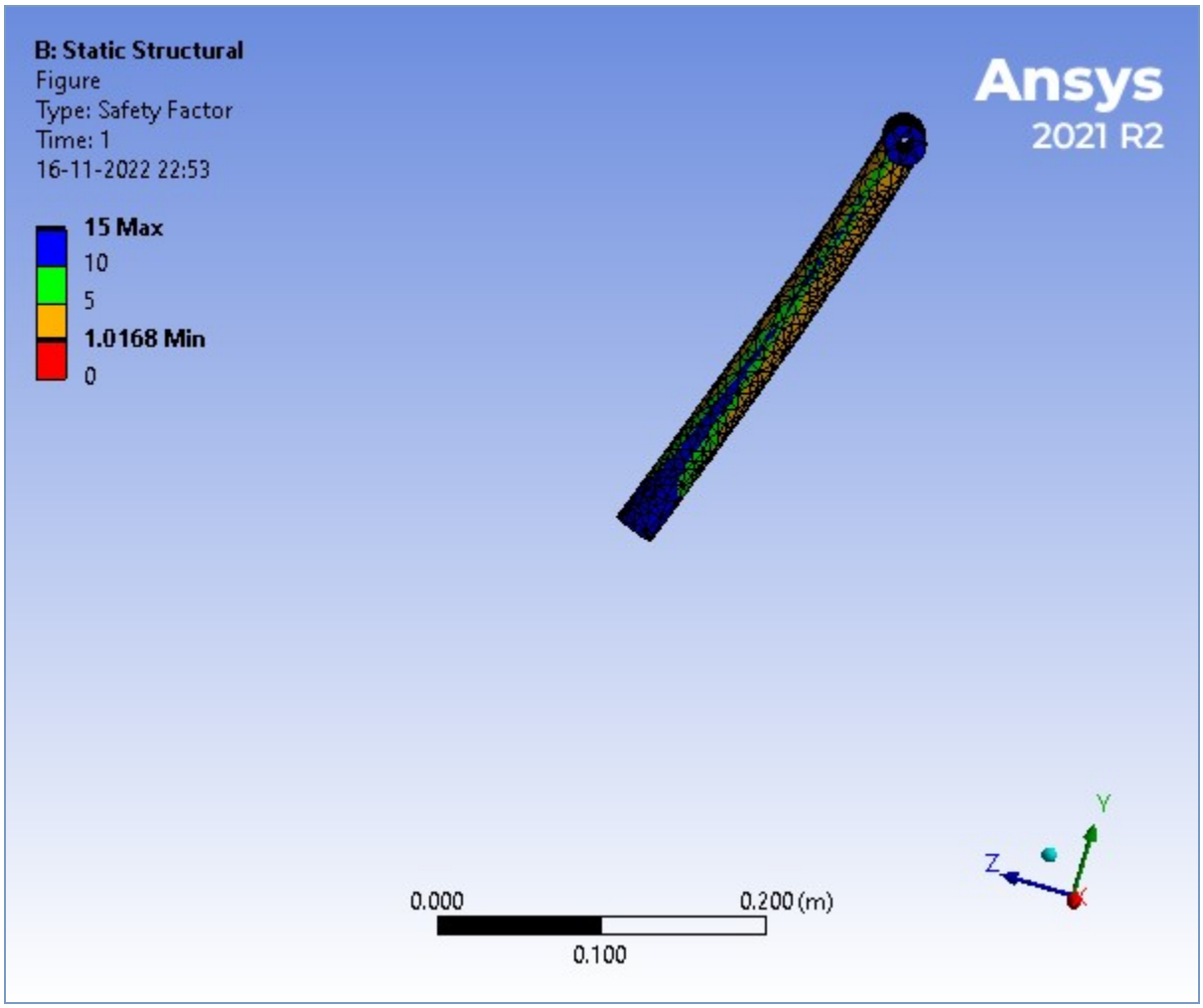


TABLE 17
Model (B4) > Static Structural (B5) > Solution (B6) > Stress Tool > Safety Factor

Time [s]	Minimum	Maximum	Average
1.	1.0168	15.	5.9765

FIGURE 7
Model (B4) > Static Structural (B5) > Solution (B6) > Stress Tool > Safety Factor > Figure



Material Data

AISI 4130

TABLE 18
AISI 4130 > Constants

Density	7850 kg m^-3

TABLE 19
AISI 4130 > Color

Red	Green	Blue
130	177	176

TABLE 20
AISI 4130 > Tensile Ultimate Strength

Tensile Ultimate Strength Pa
5.6e+008

TABLE 21
AISI 4130 > Tensile Yield Strength

Tensile Yield Strength Pa
4.6e+008

TABLE 22
AISI 4130 > Isotropic Elasticity

Young's Modulus Pa	Poisson's Ratio	Bulk Modulus Pa	Shear Modulus Pa	Temperature C
2.1e+011	0.3	1.75e+011	8.0769e+010	