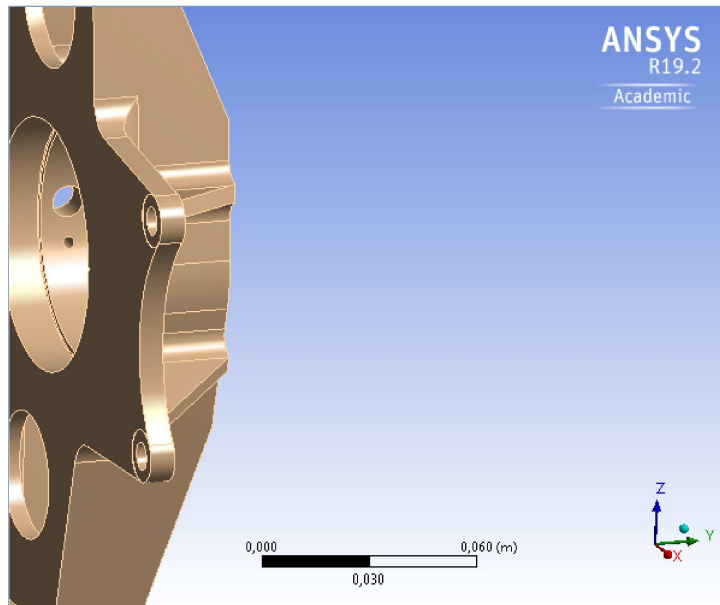




## Project

First Saved	Tuesday, December 03, 2019
Last Saved	Tuesday, December 03, 2019
Product Version	19.2 Release
Save Project Before Solution	No
Save Project After Solution	No



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## 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
<b>Definition</b>	
Source	C:\Users\cao\Documents\PAI_EPSA\porte_moyeu_files\dp0\SYS-1\DM\SYS-1.scdoc
Type	SpaceClaim
Length Unit	Meters
Element Control	Program Controlled
Display Style	Body Color
<b>Bounding Box</b>	
Length X	0,13245 m
Length Y	4,01e-002 m
Length Z	0,2642 m
<b>Properties</b>	
Volume	2,3479e-004 m³
Mass	0,65037 kg
Scale Factor Value	1,
<b>Statistics</b>	
Bodies	1
Active Bodies	1
Nodes	412010
Elements	273728
Mesh Metric	None
<b>Update Options</b>	
Assign Default Material	No
<b>Basic Geometry Options</b>	
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
<b>Advanced Geometry Options</b>	
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
Clean Bodies On Import	No
Stitch Surfaces On Import	No
Decompose Disjoint Geometry	Yes
Enclosure and Symmetry Processing	Yes

**TABLE 3**  
**Model (B4) > Geometry > Parts**

Object Name	SYS-1/Corps principal
State	Meshed
<b>Graphics Properties</b>	
Visible	Yes
Transparency	1
<b>Definition</b>	
Suppressed	No
Stiffness Behavior	Flexible
Coordinate System	Default Coordinate System
Reference Temperature	By Environment
Behavior	None
<b>Material</b>	
Assignment	Aluminum Alloy
Nonlinear Effects	Yes
Thermal Strain Effects	Yes
<b>Bounding Box</b>	
Length X	0,13245 m
Length Y	4,01e-002 m
Length Z	0,2642 m
<b>Properties</b>	
Volume	2,3479e-004 m³
Mass	0,65037 kg
Centroid X	5,8746e-003 m
Centroid Y	2,7043e-002 m
Centroid Z	-6,7305e-003 m
Moment of Inertia Ip1	2,4836e-003 kg·m²
Moment of Inertia Ip2	3,1621e-003 kg·m²
Moment of Inertia Ip3	8,4262e-004 kg·m²
<b>Statistics</b>	
Nodes	412010
Elements	273728
Mesh Metric	None
<b>CAD Attributes</b>	
PartTolerance:	0,00000001
Color:	175.143.175

### Coordinate Systems

**TABLE 4**  
**Model (B4) > Coordinate Systems > Coordinate System**

Object Name	Global Coordinate System	braking	inner	lower	upper	b	i	l	o	u
State	Fully Defined									
Type	Definition									
Coordinate System ID	0,									
Coordinate System	Program Controlled									
APDL Name										
Suppressed		No								
Origin										
Origin X	0, m	0,10385 m	7,2793e-017 m	-1,01e-002 m	-7,04e-003 m	0,10385 m	7,2793e-017 m	-1,01e-002 m	5,5812e-018 m	-7,04e-003 m
Origin Y	0, m	-1,5e-003 m	6,13e-002 m	2,9e-002 m	5,5e-002 m	-1,5e-003 m	6,13e-002 m	2,9e-002 m	4,7e-003 m	5,5e-002 m
Origin Z	0, m	-5,4276e-006 m	-3,3806e-018 m	-0,1198 m	0,1128 m	4,9946e-003 m	-3,3806e-018 m	-0,1198 m	3,3806e-018 m	0,1128 m
Define By	Global Coordinates									
Location		Defined								
Directional Vectors										
X Axis Data	[ 1, 0, 0, ]	[-1, 0, 5,2265e-005 ]	[ 1, 0, 0, ]							
Y Axis Data			[ 0, 1, 0, ]			[ 0, 0, 1, ]	[ 0, 1, 0, ]			
Z Axis Data	[ 0, 0, 1, ]	[-5,2265e-005 0, -1, ]	[ 0, 0, 1, ]			[ 0, -1, 0, ]	[ 0, 0, 1, ]			
Principal Axis										
Axis		X								
Define By		Fixed Vector								
Orientation About Principal Axis										
Axis		Y								
Define By		Fixed Vector								
Transformations										
Base Configuration		Absolute								
Transformed Configuration		[ 0,10385 - 1,5e-003 - 5,4276e-006 ]	[ 7,2793e-017 6,13e-002 - 3,3806e-018 ]	[-1,01e-002 2,9e-002 - 0,1198 ]	[-7,04e-003 5,5e-002 0,1128 ]	[ 0,10385 - 1,5e-003 4,9946e-003 ]	[ 7,2793e-017 6,13e-002 - 3,3806e-018 ]	[-1,01e-002 2,9e-002 - 0,1198 ]	[ 5,5812e-018 4,7e-003 3,3806e-018 ]	[-7,04e-003 5,5e-002 0,1128 ]

### Mesh

**TABLE 5**  
**Model (B4) > Mesh**

Object Name	Mesh
State	Solved
<b>Display</b>	
Display Style	Use Geometry Setting
<b>Defaults</b>	
Physics Preference	Mechanical
Element Order	Program Controlled
Element Size	Default
<b>Sizing</b>	
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	0,29825 m
Average Surface Area	6,1605e-004 m²
Minimum Edge Length	1,e-004 m
<b>Quality</b>	
Check Mesh Quality	Yes, Errors
Error Limits	Standard Mechanical
Target Quality	Default (0.050000)
Smoothing	Medium
Mesh Metric	None
<b>Inflation</b>	
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
<b>Advanced</b>	
Number of CPUs for Parallel Part Meshing	Program Controlled
Straight Sided Elements	No
Number of Retries	Default (4)
Rigid Body Behavior	Dimensionally Reduced
Triangle Surface Mesher	Program Controlled
Topology Checking	Yes
Pinch Tolerance	Please Define
Generate Pinch on Refresh	No
<b>Statistics</b>	
Nodes	412010
Elements	273728

**TABLE 6**  
**Model (B4) > Mesh > Mesh Controls**

Object Name	<i>Body Sizing</i>
State	Fully Defined
<b>Scope</b>	
Scoping Method	Geometry Selection
Geometry	1 Body
<b>Definition</b>	
Suppressed	No
Type	Element Size
Element Size	2,e-003 m
<b>Advanced</b>	
Defeature Size	Default
Behavior	Soft

## Static Structural (B5)

**TABLE 7**  
**Model (B4) > Analysis**

Object Name	<i>Static Structural (B5)</i>
State	Solved
<b>Definition</b>	
Physics Type	Structural
Analysis Type	Static Structural
Solver Target	Mechanical APDL
<b>Options</b>	
Environment Temperature	22, °C
Generate Input Only	No

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

Object Name	<i>Analysis Settings</i>
State	Fully Defined
<b>Step Controls</b>	
Number Of Steps	1,
Current Step Number	1,
Step End Time	1, s
Auto Time Stepping	Program Controlled
<b>Solver Controls</b>	
Solver Type	Program Controlled
Weak Springs	Off
Solver Pivot Checking	Program Controlled
Large Deflection	Off
Inertia Relief	Off
<b>Rotordynamics Controls</b>	
Coriolis Effect	Off
<b>Restart Controls</b>	
Generate Restart Points	Program Controlled
Retain Files After Full Solve	No
Combine Restart Files	Program Controlled
<b>Nonlinear Controls</b>	
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	Off
<b>Output Controls</b>	

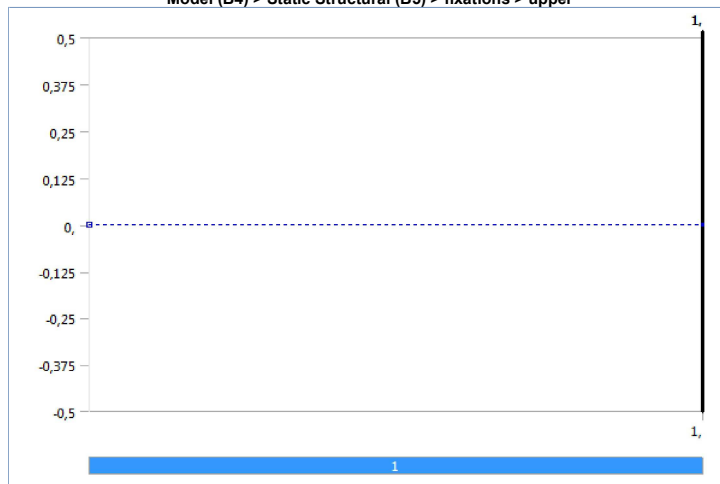
Stress	Yes
Strain	Yes
Nodal Forces	No
Contact Miscellaneous	No
General Miscellaneous	No
Store Results At	All Time Points
<b>Analysis Data Management</b>	
Solver Files Directory	C:\Users\cao\Documents\PAI_EPSA\porte moyeu_files\dp0\SYS-1\MECH\
Future Analysis	None
Scratch Solver Files Directory	
Save MAPDL db	No
Contact Summary	Program Controlled
Delete Unneeded Files	Yes
Nonlinear Solution	Yes
Solver Units	Active System
Solver Unit System	mks

### fixations

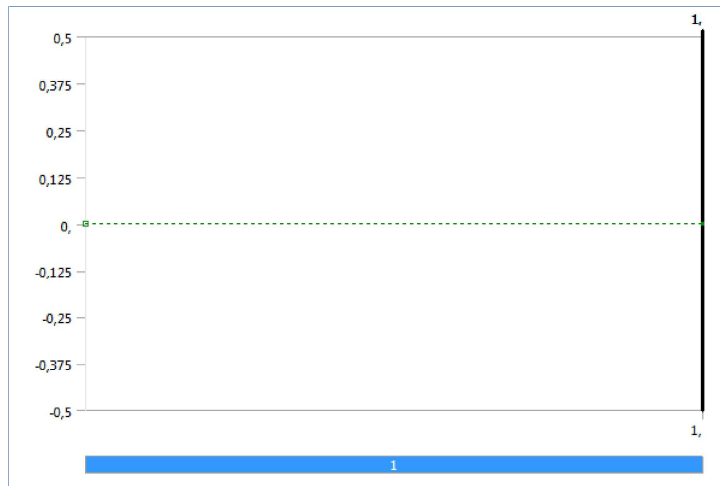
**TABLE 9**  
**Model (B4) > Static Structural (B5) > fixations > Loads**

Object Name	<i>upper</i>	<i>lower</i>	<i>inner</i>
State	Fully Defined		
Scope			
Scoping Method	Geometry Selection		
Geometry	3 Faces	4 Faces	3 Faces
Coordinate System	u	l	i
X Coordinate	0, m		
Y Coordinate	0, m		
Z Coordinate	0, m		
Location	Defined		
Definition			
Type	Remote Displacement		
X Component	0, m (ramped)		
Y Component	0, m (ramped)		
Z Component	0, m (ramped)	Free	0, m (ramped)
Rotation X	Free		
Rotation Y	Free		
Rotation Z	Free		
Suppressed	No		
Behavior	Deformable		
Rotation X		Free	
Rotation Y		Free	
Rotation Z		Free	
Rotation X			0, ° (ramped)
Rotation Y			0, ° (ramped)
Rotation Z			0, ° (ramped)
Advanced			
Pinball Region	All		

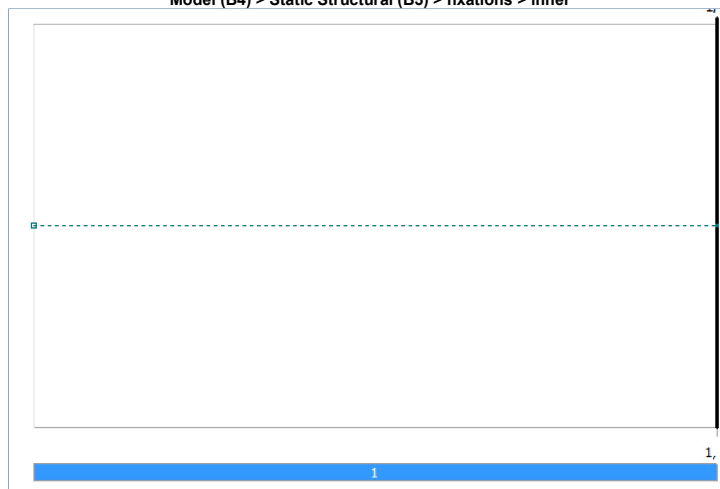
**FIGURE 1**  
**Model (B4) > Static Structural (B5) > fixations > upper**



**FIGURE 2**  
**Model (B4) > Static Structural (B5) > fixations > lower**



**FIGURE 3**  
Model (B4) > Static Structural (B5) > fixations > inner



*compression only*

**TABLE 10**  
Model (B4) > Static Structural (B5) > compression only > Loads

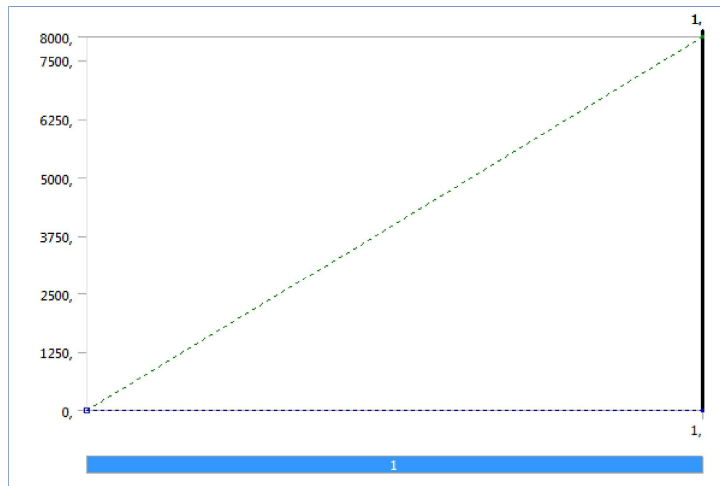
Object Name		outer	inner
State		Fully Defined	
Scope			
Scoping Method		Geometry Selection	
Geometry		3 Faces	
Definition			
Type		Compression Only Support	
Suppressed		No	
Advanced			
Normal Stiffness		Program Controlled	
Update Stiffness		Never	

*chargement*

**TABLE 11**  
Model (B4) > Static Structural (B5) > chargement > Loads

Object Name	<i>Remote Force</i>
State	Fully Defined
<b>Scope</b>	
Scoping Method	Geometry Selection
Geometry	4 Faces
Coordinate System	b
X Coordinate	0, m
Y Coordinate	5,e-003 m
Z Coordinate	0, m
Location	Defined
<b>Definition</b>	
Type	Remote Force
Define By	Components
X Component	0, N (ramped)
Y Component	8000, N (ramped)
Z Component	0, N (ramped)
Suppressed	No
Behavior	Deformable
<b>Advanced</b>	
Pinball Region	All

**FIGURE 4**  
Model (B4) > Static Structural (B5) > chargement > Remote Force



### Solution (B6)

**TABLE 12**  
Model (B4) > Static Structural (B5) > Solution

Object Name	Solution (B6)
State	Solved
<b>Adaptive Mesh Refinement</b>	
Max Refinement Loops	1,
Refinement Depth	2,
<b>Information</b>	
Status	Done
MAPDL Elapsed Time	35 m 17 s
MAPDL Memory Used	2,5488 GB
MAPDL Result File Size	222,94 MB
<b>Post Processing</b>	
Beam Section Results	No
On Demand Stress/Strain	No

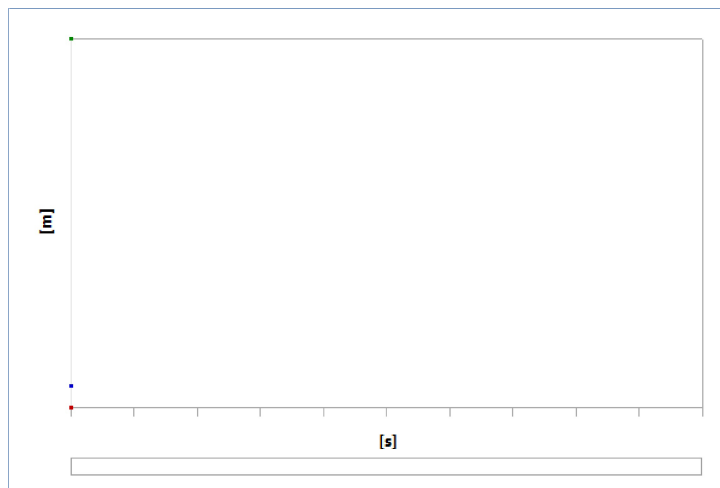
**TABLE 13**  
Model (B4) > Static Structural (B5) > Solution (B6) > Solution Information

Object Name	Solution Information
State	Solved
<b>Solution Information</b>	
Solution Output	Solver Output
Newton-Raphson Residuals	0
Identify Element Violations	0
Update Interval	2,5 s
Display Points	All
<b>FE Connection Visibility</b>	
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 14**  
Model (B4) > Static Structural (B5) > Solution (B6) > Results

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	3,1993e-008 m	19842 Pa
Maximum	2,6784e-004 m	2,0387e+008 Pa
Average	1,5485e-005 m	1,4208e+007 Pa
Minimum Occurs On	SYS-1\Corps principal	
Maximum Occurs On	SYS-1\Corps principal	
Information		
Time	1, s	
Load Step	1	
Substep	1	
Iteration Number	10	
Integration Point Results		
Display Option		Averaged
Average Across Bodies		No

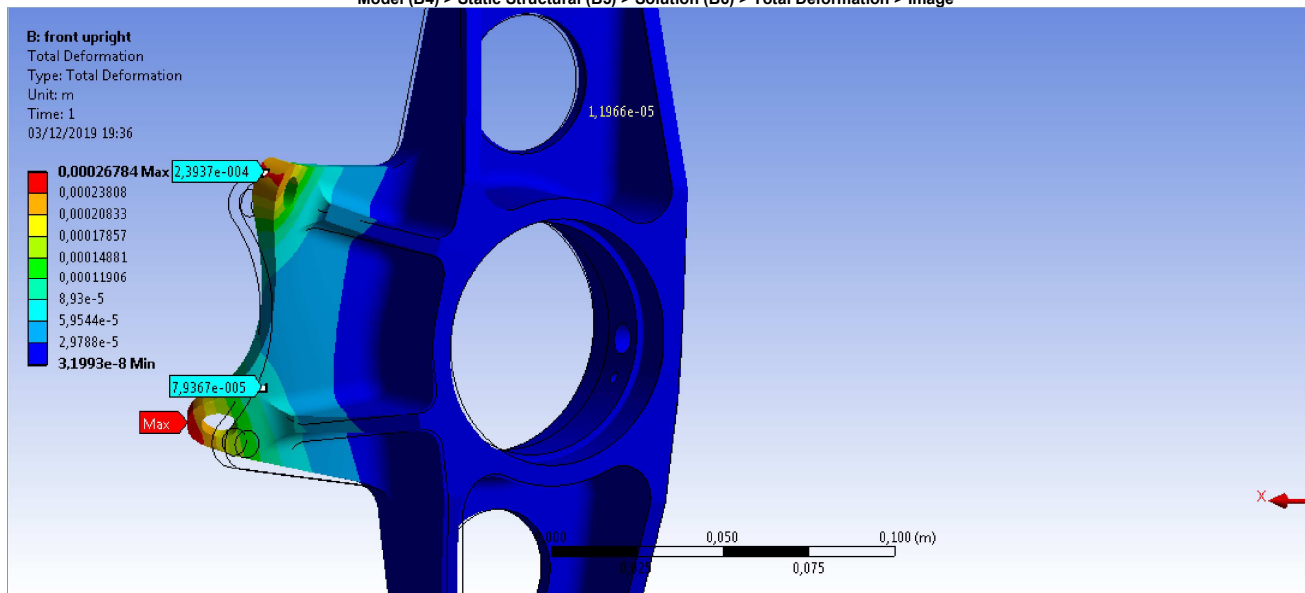
**FIGURE 5**  
Model (B4) > Static Structural (B5) > Solution (B6) > Total Deformation



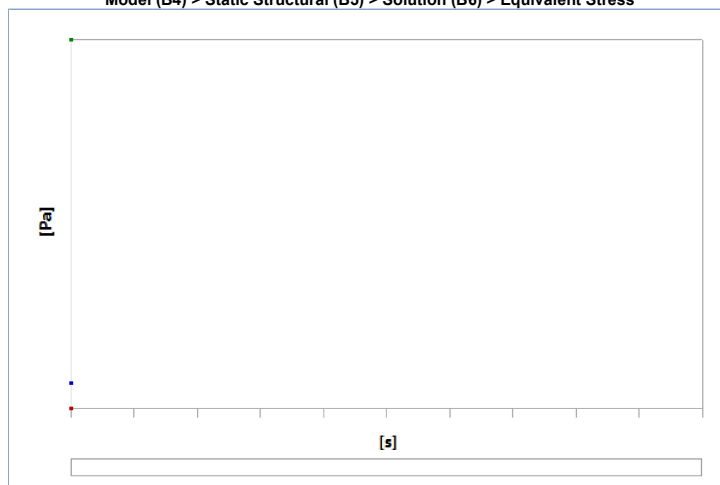
**TABLE 15**  
Model (B4) > Static Structural (B5) > Solution (B6) > Total Deformation

Time [s]	Minimum [m]	Maximum [m]	Average [m]
1,	3,1993e-008	2,6784e-004	1,5485e-005

**FIGURE 6**  
Model (B4) > Static Structural (B5) > Solution (B6) > Total Deformation > Image



**FIGURE 7**  
Model (B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress



**TABLE 16**  
Model (B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress

Time [s]	Minimum [Pa]	Maximum [Pa]	Average [Pa]
1,	19842	2,0387e+008	1,4208e+007

**FIGURE 8**  
Model (B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress > Image



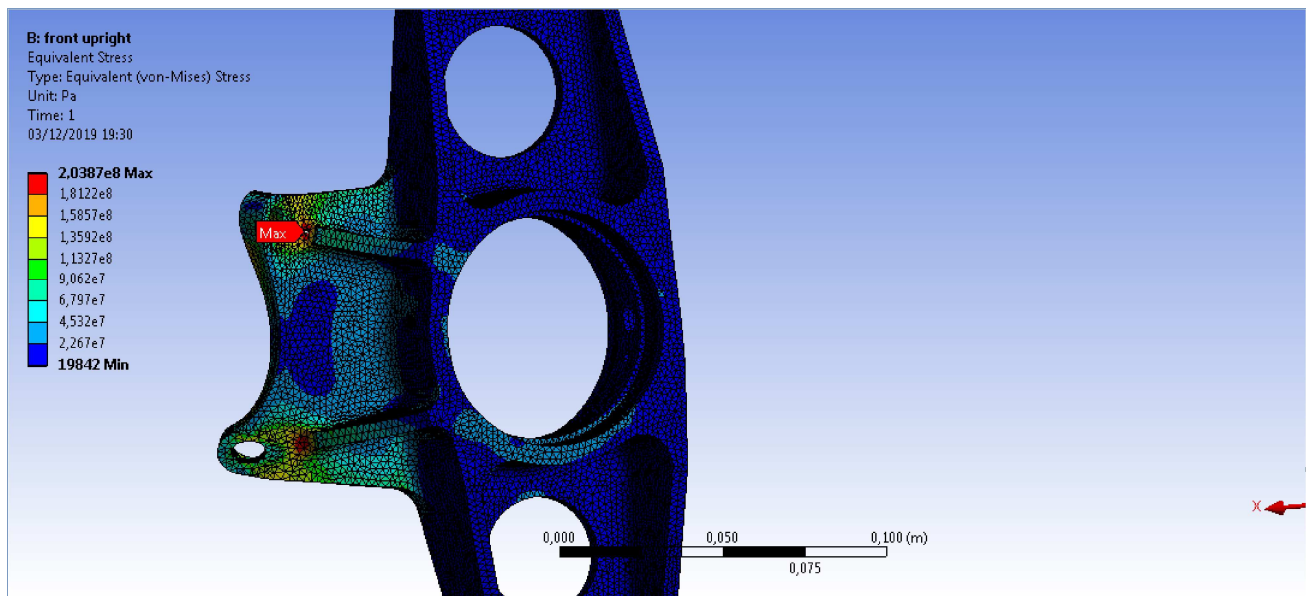


FIGURE 9  
Model (B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress > Image

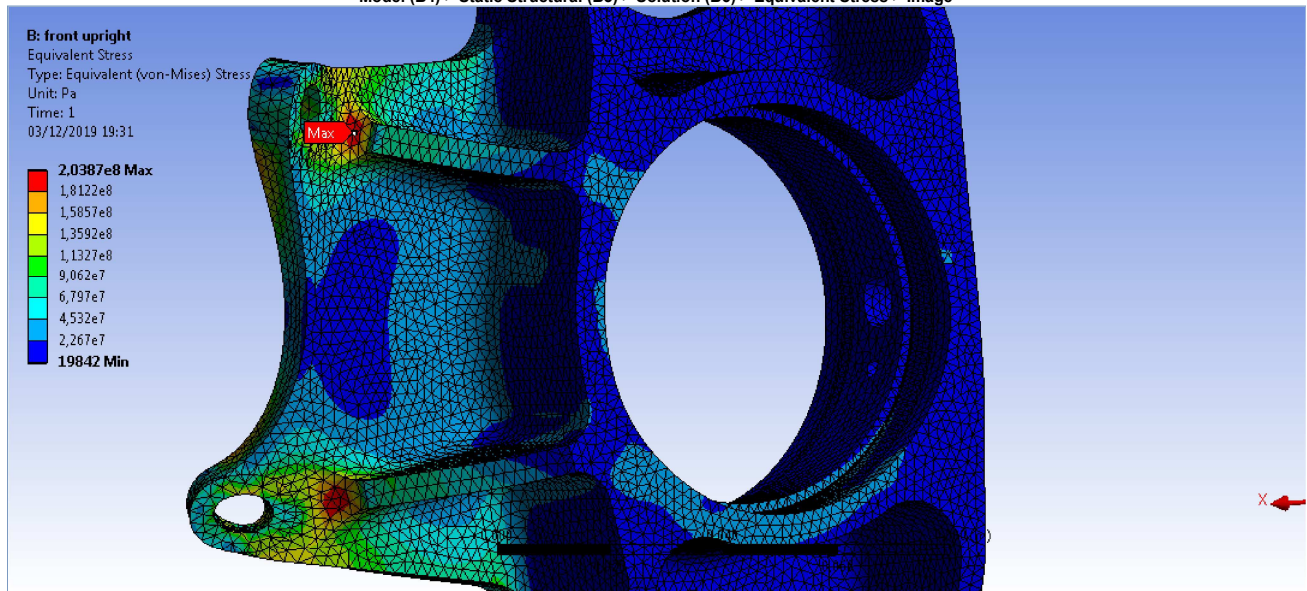


FIGURE 10  
Model (B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress > Image

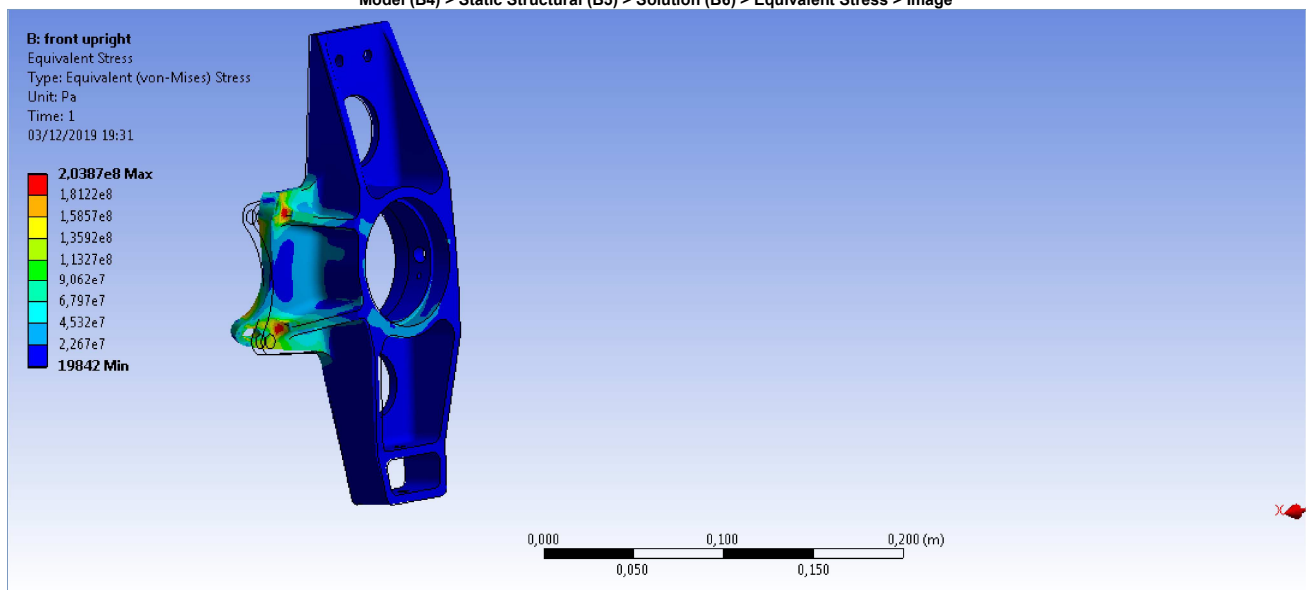
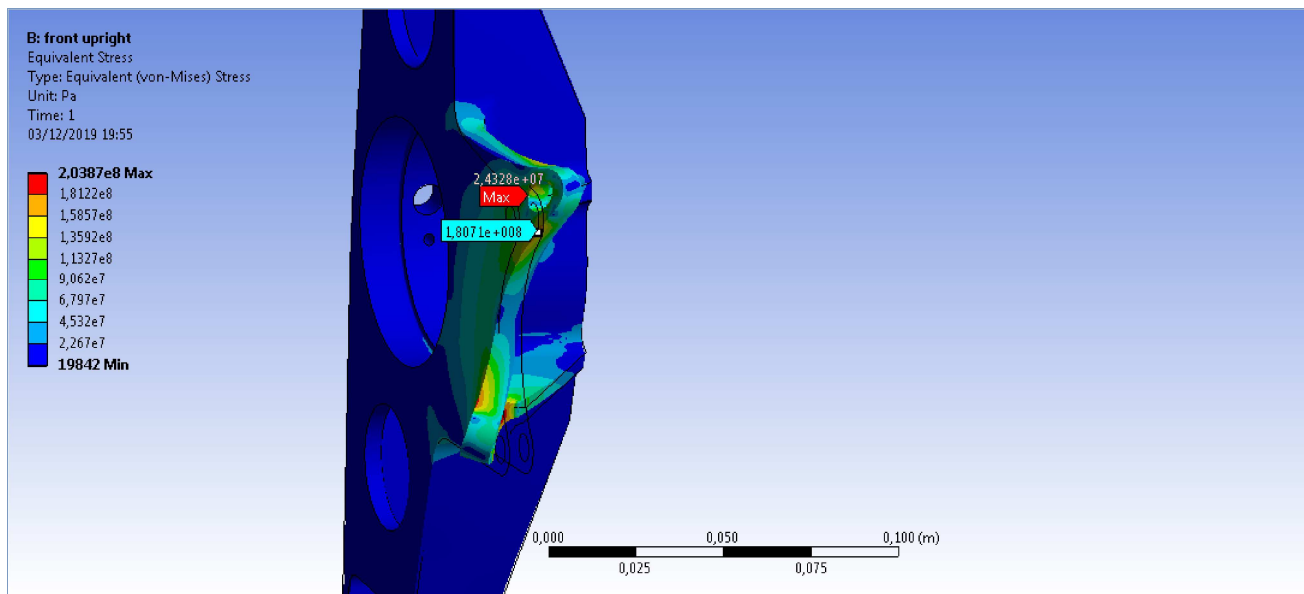


FIGURE 11  
Model (B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress > Image



## Material Data

### Aluminum Alloy

**TABLE 17**  
Aluminum Alloy > Constants

Density	2770, kg m <sup>-3</sup>
Coefficient of Thermal Expansion	2,3e-005 C <sup>-1</sup>
Specific Heat	875, J kg <sup>-1</sup> C <sup>-1</sup>

**TABLE 18**  
Aluminum Alloy > Color

Red	Green	Blue
138,	104,	46,

**TABLE 19**  
Aluminum Alloy > Compressive Ultimate Strength

Compressive Ultimate Strength Pa
0,

**TABLE 20**  
Aluminum Alloy > Compressive Yield Strength

Compressive Yield Strength Pa
2,8e+008

**TABLE 21**  
Aluminum Alloy > Tensile Yield Strength

Tensile Yield Strength Pa
2,8e+008

**TABLE 22**  
Aluminum Alloy > Tensile Ultimate Strength

Tensile Ultimate Strength Pa
3,1e+008

**TABLE 23**  
Aluminum Alloy > Isotropic Secant Coefficient of Thermal Expansion

Zero-Thermal-Strain Reference Temperature C
22,

**TABLE 24**  
Aluminum Alloy > Isotropic Thermal Conductivity

Thermal Conductivity W m <sup>-1</sup> C <sup>-1</sup>	Temperature C
114,	-100,
144,	0,
165,	100,
175,	200,

**TABLE 25**  
Aluminum Alloy > S-N Curve

Alternating Stress Pa	Cycles	R-Ratio
2,758e+008	1700,	-1,
2,413e+008	5000,	-1,
2,068e+008	34000	-1,
1,724e+008	1,4e+005	-1,
1,379e+008	8,e+005	-1,
1,172e+008	2,4e+006	-1,
8,963e+007	5,5e+007	-1,
8,274e+007	1,e+008	-1,
1,706e+008	50000	-0,5
1,396e+008	3,5e+005	-0,5
1,086e+008	3,7e+006	-0,5
8,791e+007	1,4e+007	-0,5
7,757e+007	5,e+007	-0,5
7,239e+007	1,e+008	-0,5

1,448e+008	50000	0,
1,207e+008	1,9e+005	0,
1,034e+008	1,3e+006	0,
9,308e+007	4,4e+006	0,
8,618e+007	1,2e+007	0,
7,239e+007	1,e+008	0,
7,412e+007	3,e+005	0,5
7,067e+007	1,5e+006	0,5
6,636e+007	1,2e+007	0,5
6,205e+007	1,e+008	0,5

**TABLE 26**  
**Aluminum Alloy > Isotropic Resistivity**

Resistivity ohm m	Temperature C
2,43e-008	0,
2,67e-008	20,
3,63e-008	100,

**TABLE 27**  
**Aluminum Alloy > Isotropic Elasticity**

Young's Modulus Pa	Poisson's Ratio	Bulk Modulus Pa	Shear Modulus Pa	Temperature C
7,1e+010	0,33	6,9608e+010	2,6692e+010	

**TABLE 28**  
**Aluminum Alloy > Isotropic Relative Permeability**

Relative Permeability
1,