

Caster Wheel Stress Analysis Report



Analyzed File:	Assembly.iam
Autodesk Inventor Version:	2020 (Build 240168000, 168)
Creation Date:	7/30/2021, 11:41 AM
Study Author:	Bisqwit
Summary:	

Project Info (iProperties)

Summary

Author joelm

Project

Part Number	Assembly
Designer	joelm
Cost	\$0.00
Date Created	6/13/2021

Status

Design Status WorkInProgress

Physical

Mass	3.67297 kg
Area	116128 mm ²
Volume	474513 mm ³
Center of Gravity	x=169.039 mm y=180.219 mm z=50.6434 mm

Note: Physical values could be different from Physical values used by FEA reported below.

Static Analysis:1

General objective and settings:

Design Objective	Single Point
Study Type	Static Analysis
Last Modification Date	7/30/2021, 11:40 AM
Detect and Eliminate Rigid Body Modes	No
Separate Stresses Across Contact Surfaces	No
Motion Loads Analysis	No

Mesh settings:

Avg. Element Size (fraction of model diameter)	0.1
Min. Element Size (fraction of avg. size)	0.2
Grading Factor	1.5
Max. Turn Angle	60 deg

Create Curved Mesh Elements	No
Use part based measure for Assembly mesh	Yes

Material(s)

Name	Steel, Carbon	
General	Mass Density	7.85 g/cm ³
	Yield Strength	350 MPa
	Ultimate Tensile Strength	420 MPa
Stress	Young's Modulus	200 GPa
	Poisson's Ratio	0.29 ul
	Shear Modulus	77.5194 GPa
Part Name(s)	axle.ipt axleSupport.ipt topPlate.ipt wheel.ipt	
Name	Iron, Malleable	
General	Mass Density	7.15 g/cm ³
	Yield Strength	483 MPa
	Ultimate Tensile Strength	586 MPa
Stress	Young's Modulus	110 GPa
	Poisson's Ratio	0.3 ul
	Shear Modulus	42.3077 GPa
Part Name(s)	axleSupportMirror.ipt	

Operating conditions

Gravity

Load Type	Gravity
Magnitude	9810.000 mm/s ²
Vector X	0.000 mm/s ²
Vector Y	-9810.000 mm/s ²
Vector Z	0.000 mm/s ²

Selected Face(s)

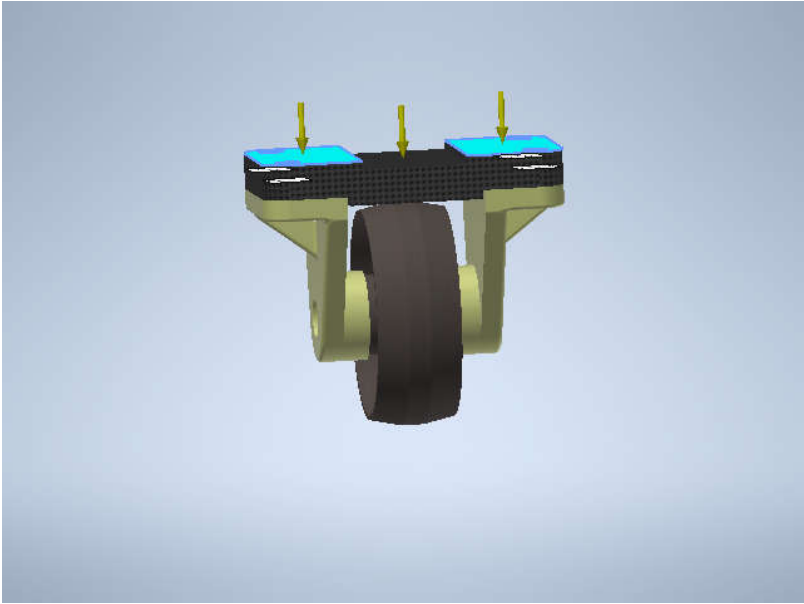




☒ **Force:1**

Load Type	Force
Magnitude	100000.000 N
Vector X	0.000 N
Vector Y	-100000.000 N
Vector Z	0.000 N

☒ **Selected Face(s)**



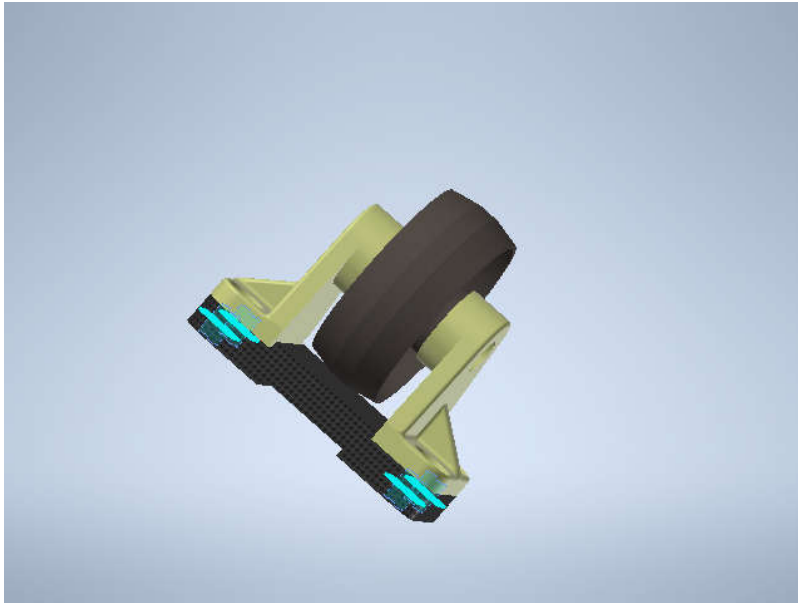


Fixed Constraint:1

Constraint Type	Fixed Constraint
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Selected Face(s)





☐ Contacts (Bonded)

Name	Part Name(s)
Bonded:1	axleSupport:1 topPlate:1
Bonded:2	topPlate:1 axleSupportMirror:1
Bonded:3	axle:1 axleSupportMirror:1
Bonded:4	axle:1 axleSupport:1
Bonded:5	axle:1 wheel:1
Bonded:6	axle:1 axleSupport:1
Bonded:7	axle:1 axleSupportMirror:1

☐ Results

☐ Reaction Force and Moment on Constraints

Constraint Name	Reaction Force		Reaction Moment	
	Magnitude	Component (X,Y,Z)	Magnitude	Component (X,Y,Z)
Fixed Constraint:1	100036 N	0 N	0 N m	0 N m
		100036 N		0 N m
		0 N		0 N m

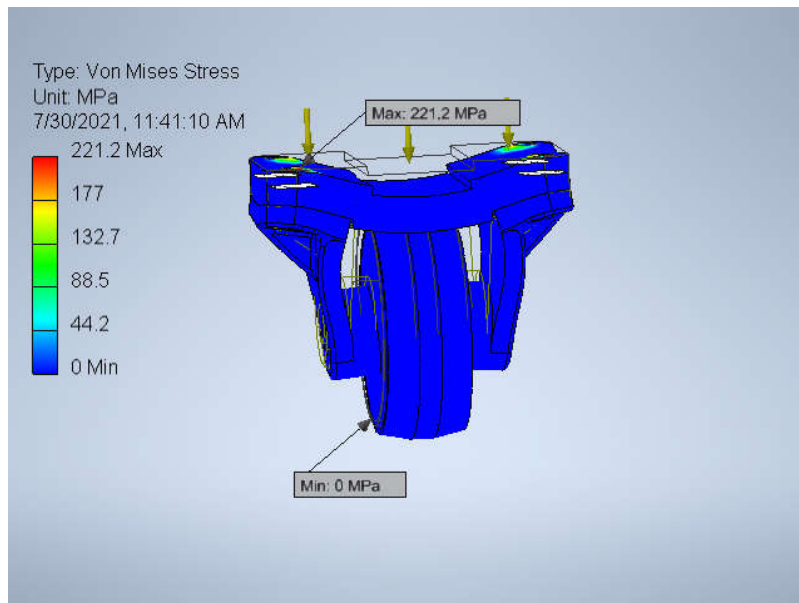
☐ Result Summary

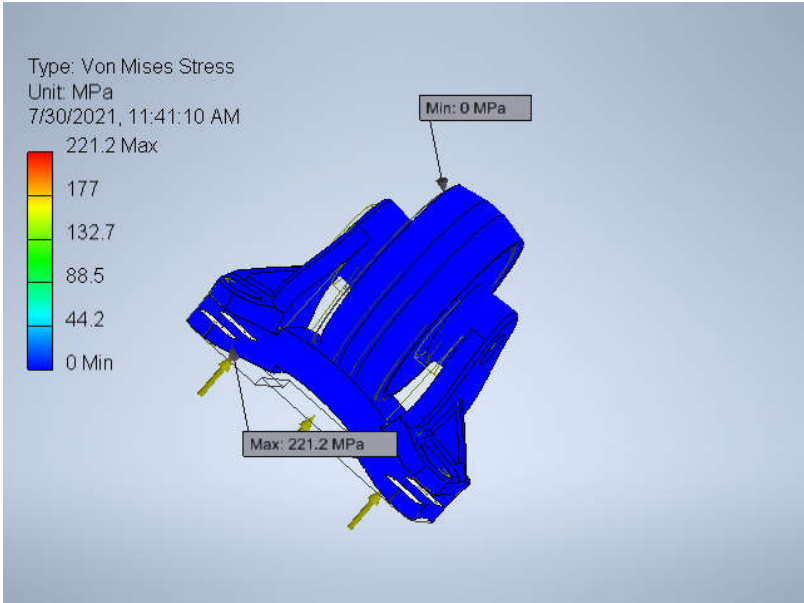
Name	Minimum	Maximum
Volume	474513 mm^3	
Mass	3.67297 kg	
Von Mises Stress	0.00135845 MPa	221.24 MPa
1st Principal Stress	-14.8925 MPa	286.101 MPa
3rd Principal Stress	-231.808 MPa	44.9064 MPa
Displacement	0 mm	0.0222682 mm
Safety Factor	1.58199 ul	15 ul
Stress XX	-155.669 MPa	226.907 MPa
Stress XY	-94.0318 MPa	87.964 MPa
Stress XZ	-66.7688 MPa	65.4464 MPa

Stress YY	-69.5474 MPa	95.9923 MPa
Stress YZ	-76.474 MPa	79.4234 MPa
Stress ZZ	-96.62 MPa	131.973 MPa
X Displacement	-0.0127801 mm	0.012597 mm
Y Displacement	-0.0222668 mm	0.00141943 mm
Z Displacement	-0.00296692 mm	0.00263106 mm
Equivalent Strain	0.00000000610428 ul	0.00104063 ul
1st Principal Strain	-0.0000149066 ul	0.0012262 ul
3rd Principal Strain	-0.00104658 ul	-0.00000000238463 ul
Strain XX	-0.000600105 ul	0.000876515 ul
Strain XY	-0.000606505 ul	0.000567368 ul
Strain XZ	-0.000430659 ul	0.000422129 ul
Strain YY	-0.000307693 ul	0.000693268 ul
Strain YZ	-0.000493257 ul	0.000512281 ul
Strain ZZ	-0.000309242 ul	0.000512303 ul
Contact Pressure	0 MPa	107.745 MPa
Contact Pressure X	-42.9718 MPa	69.8968 MPa
Contact Pressure Y	-79.3199 MPa	32.9635 MPa
Contact Pressure Z	-32.5839 MPa	40.2649 MPa

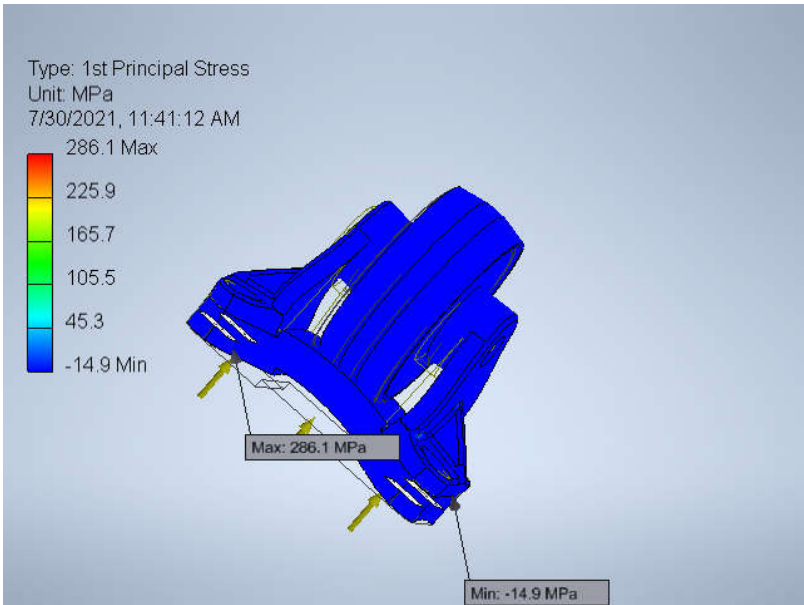
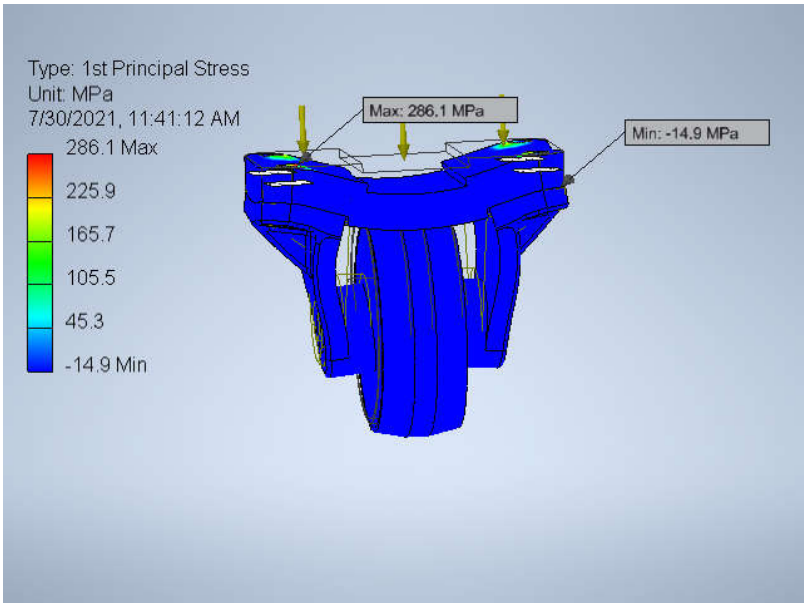
Figures

Von Mises Stress

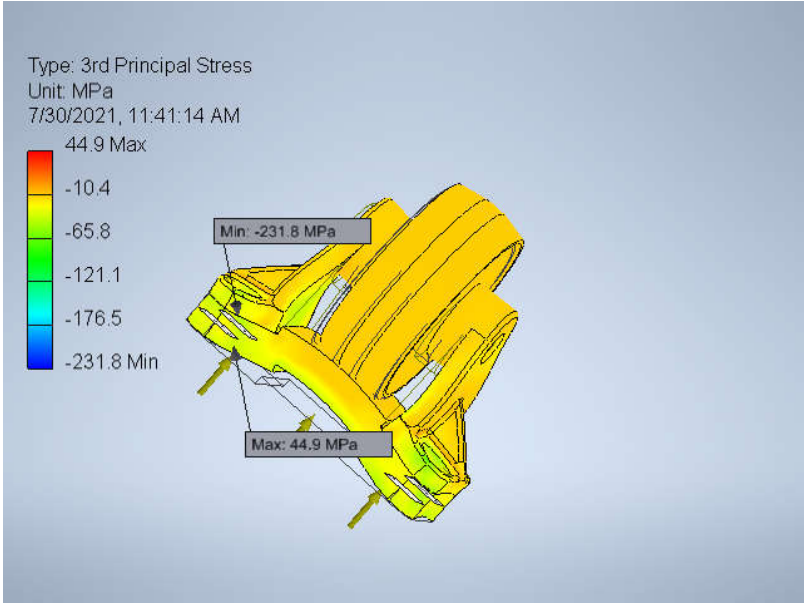
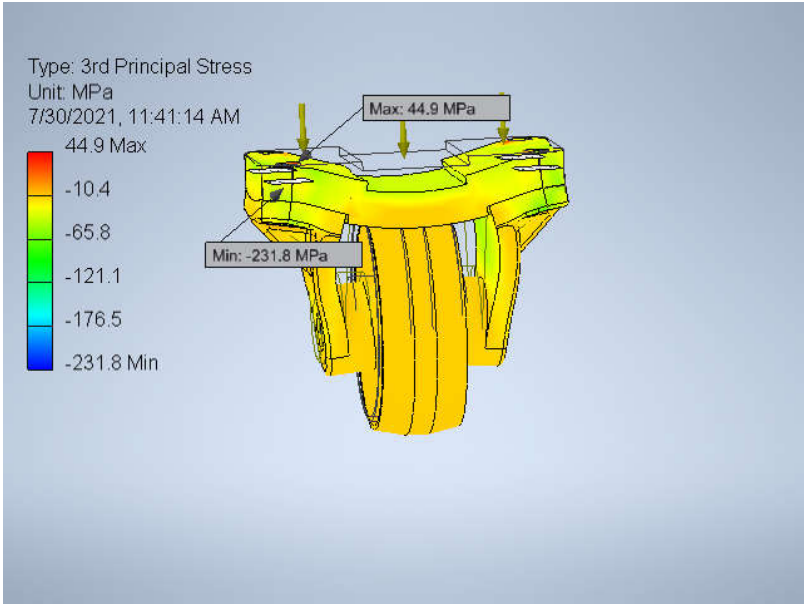




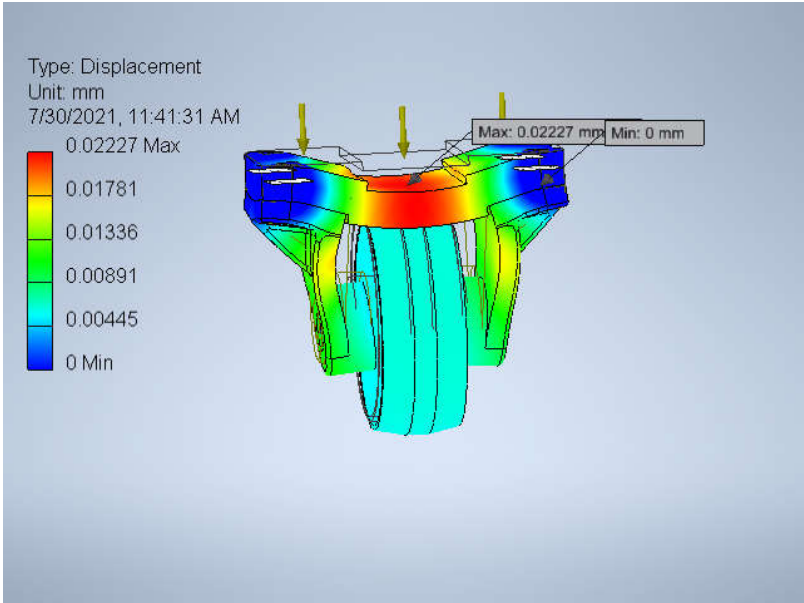
1st Principal Stress

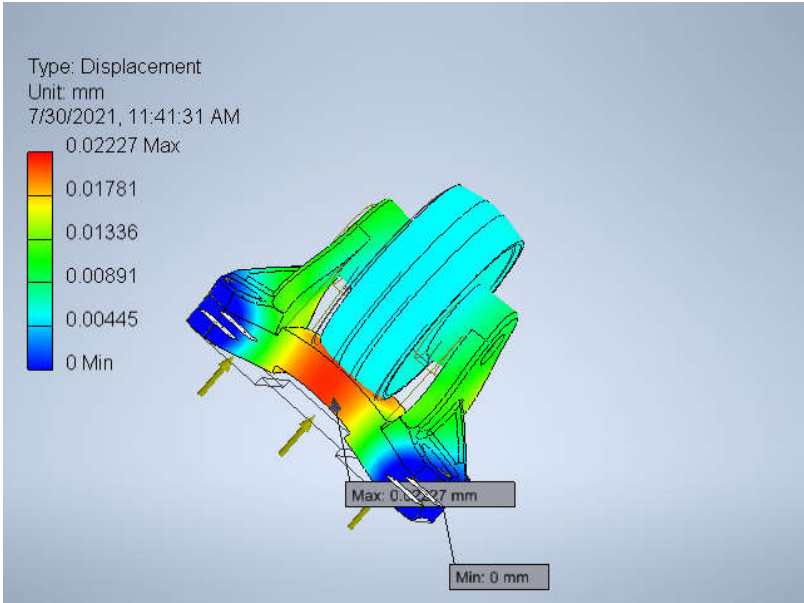


3rd Principal Stress

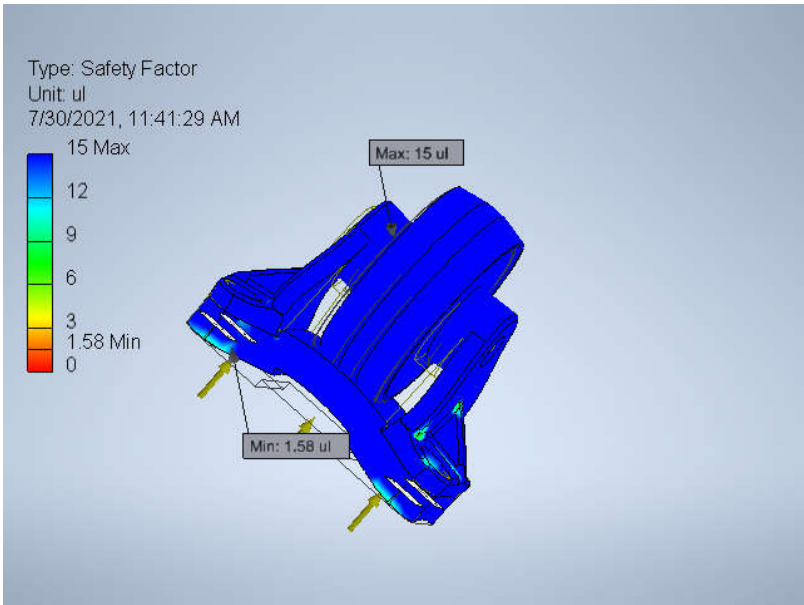
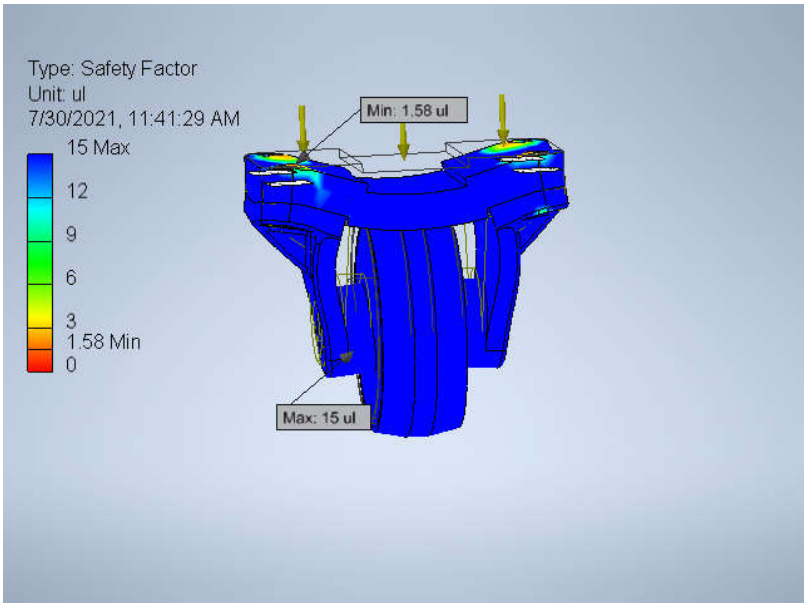


Displacement

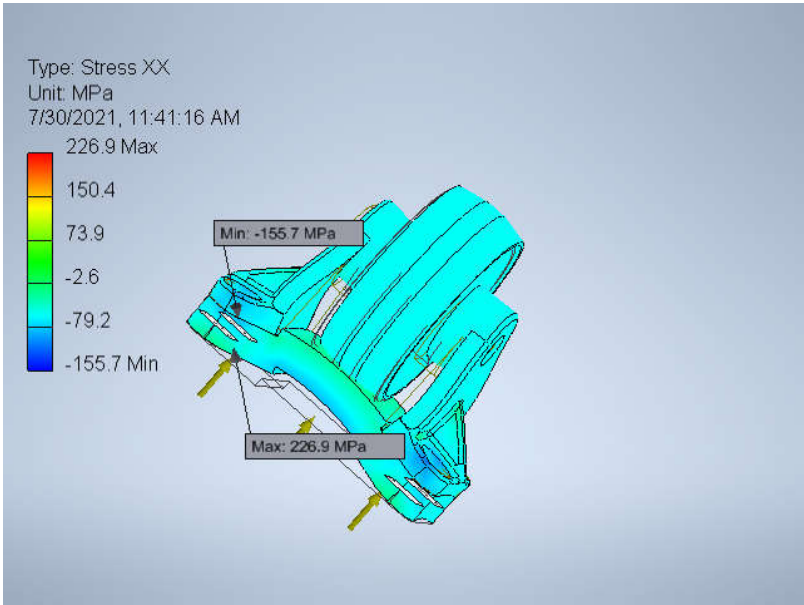
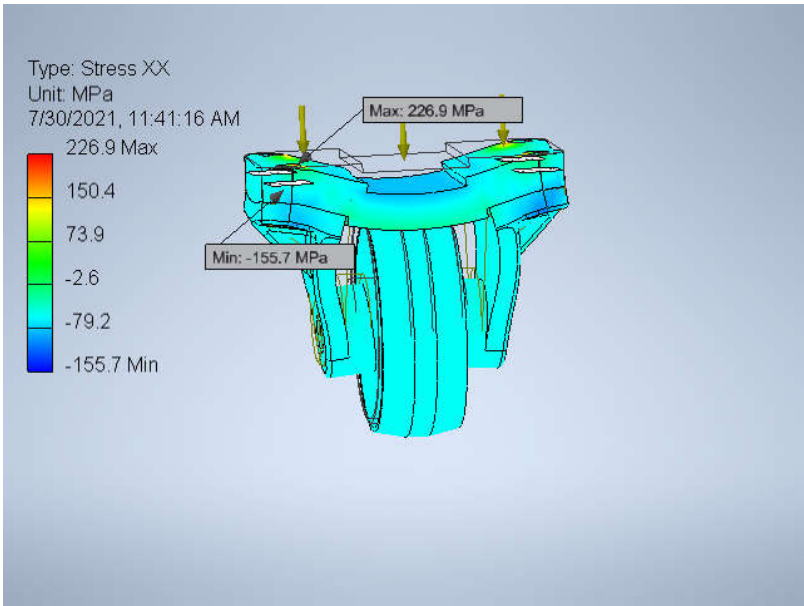




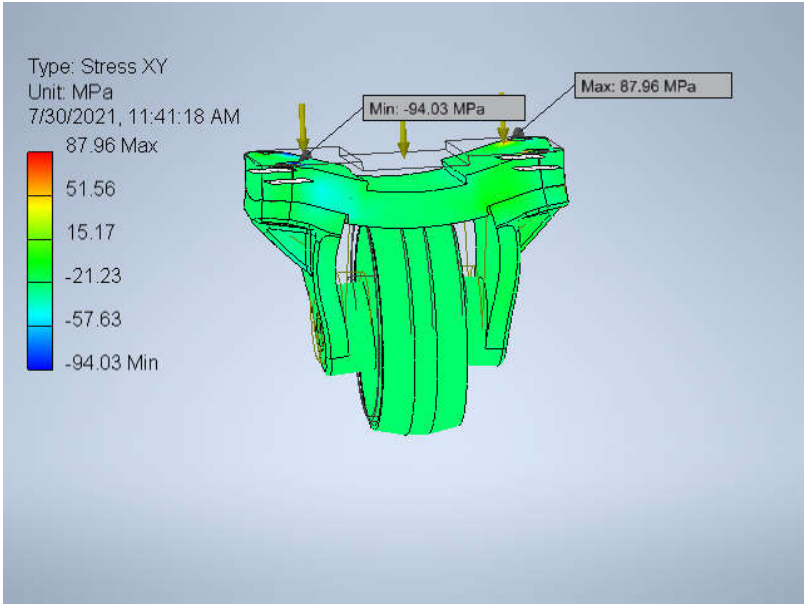
Safety Factor

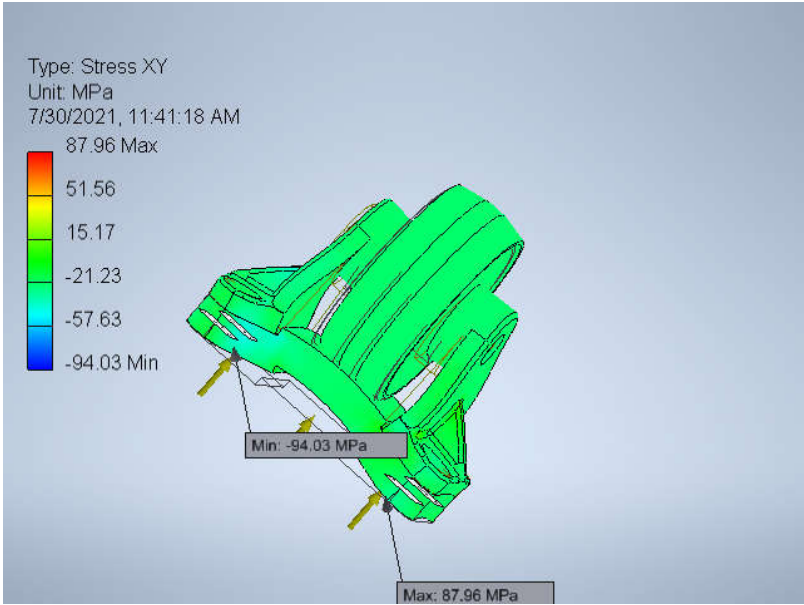


Stress XX

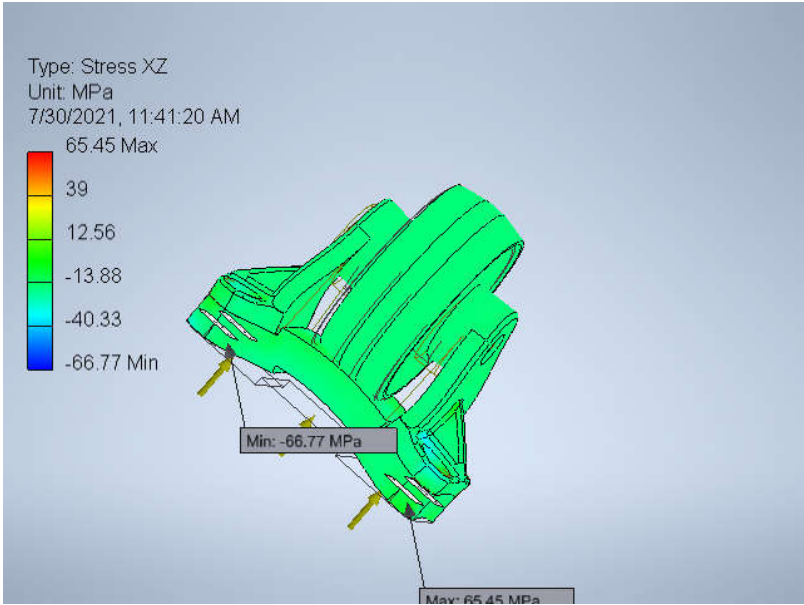
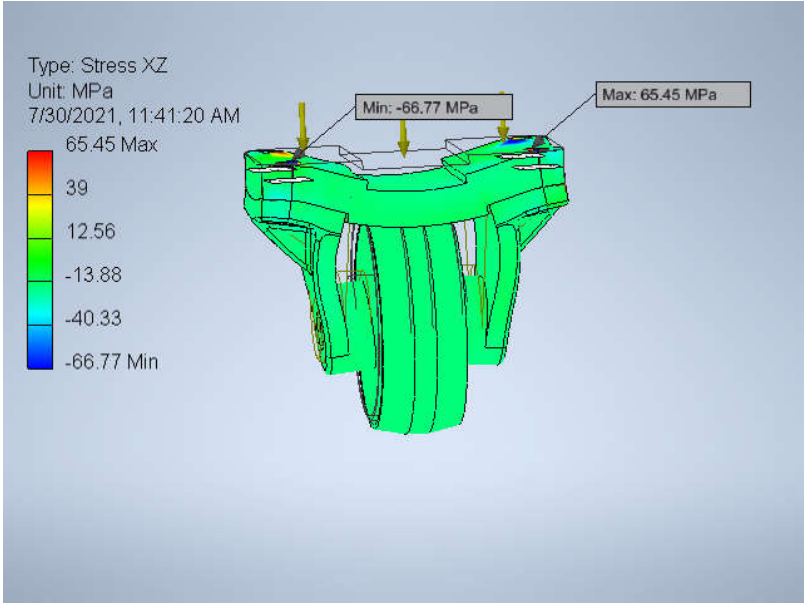


Stress XY

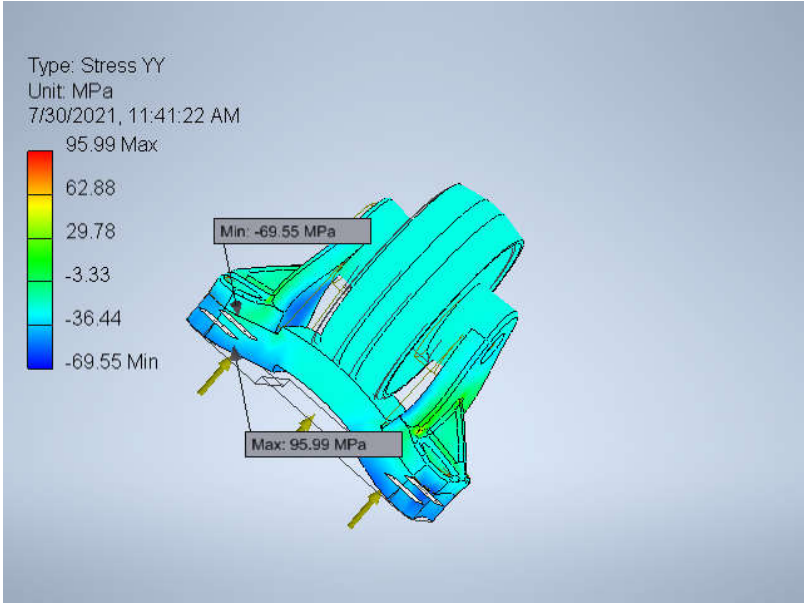
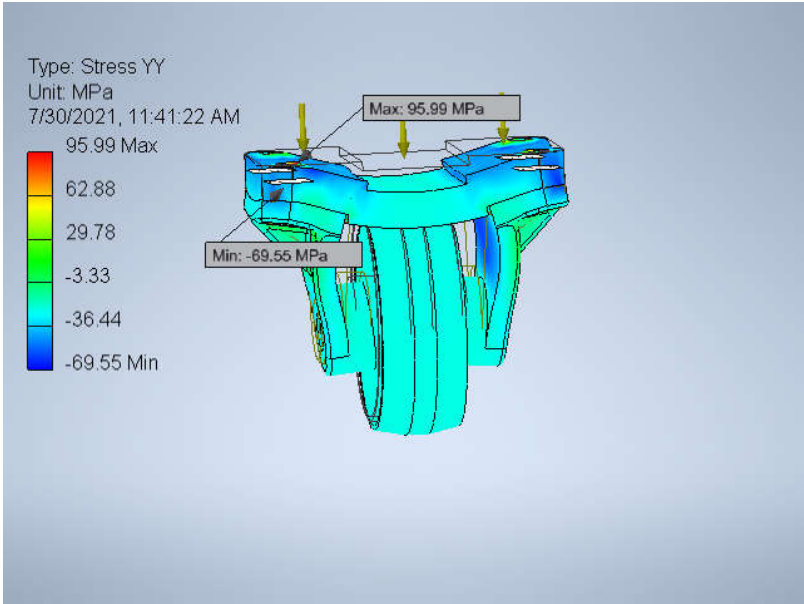




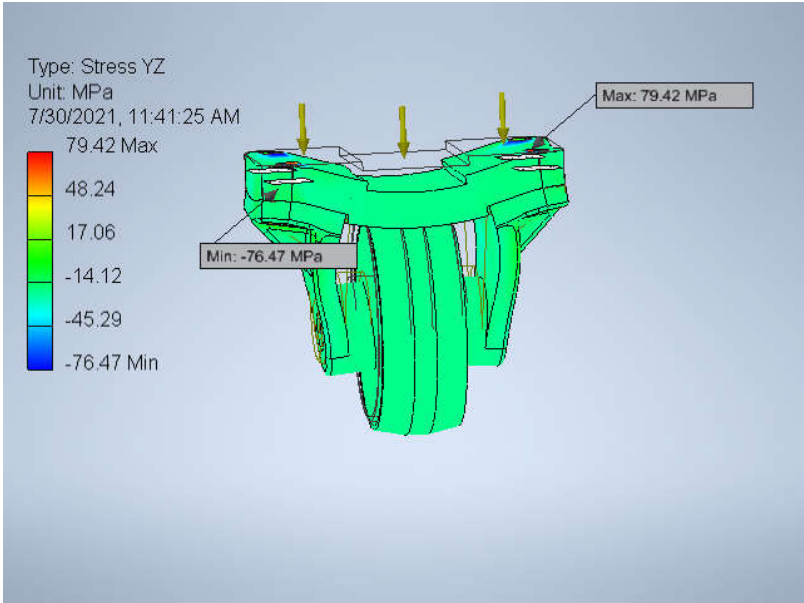
☐ Stress XZ

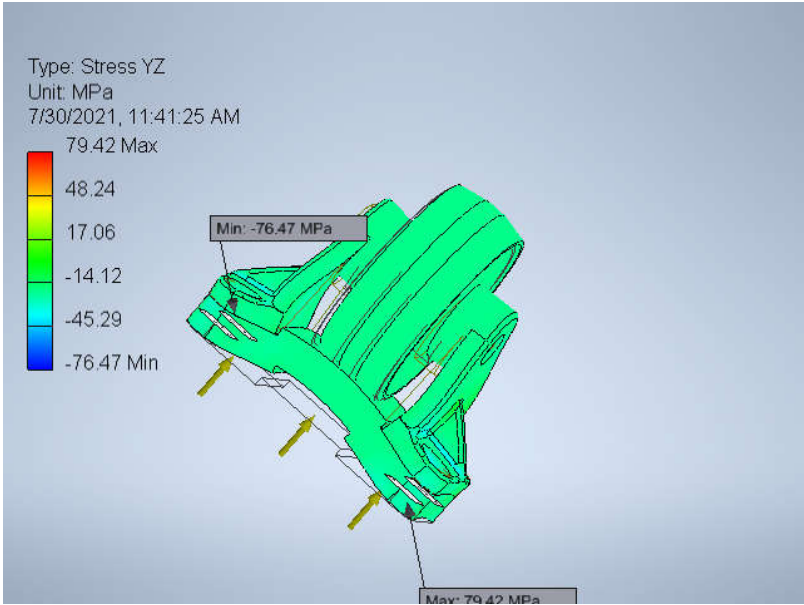


Stress YY

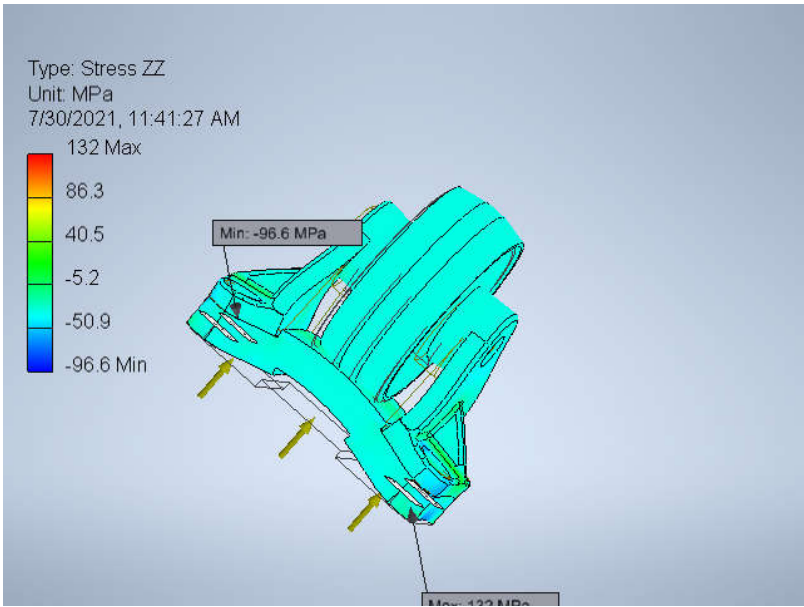
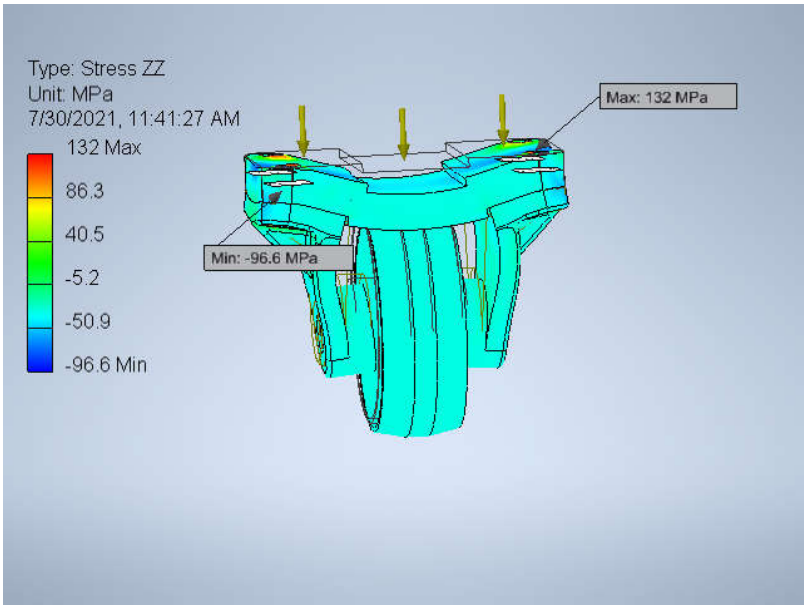


Stress YZ

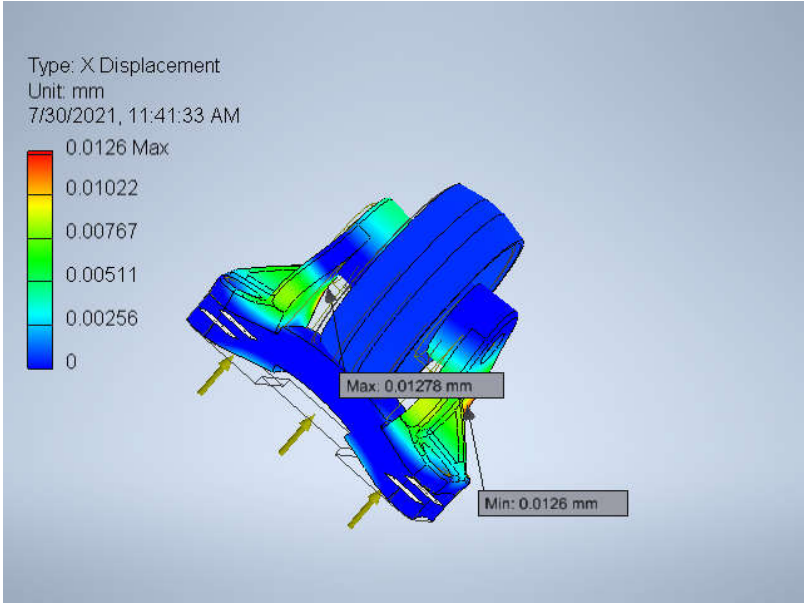
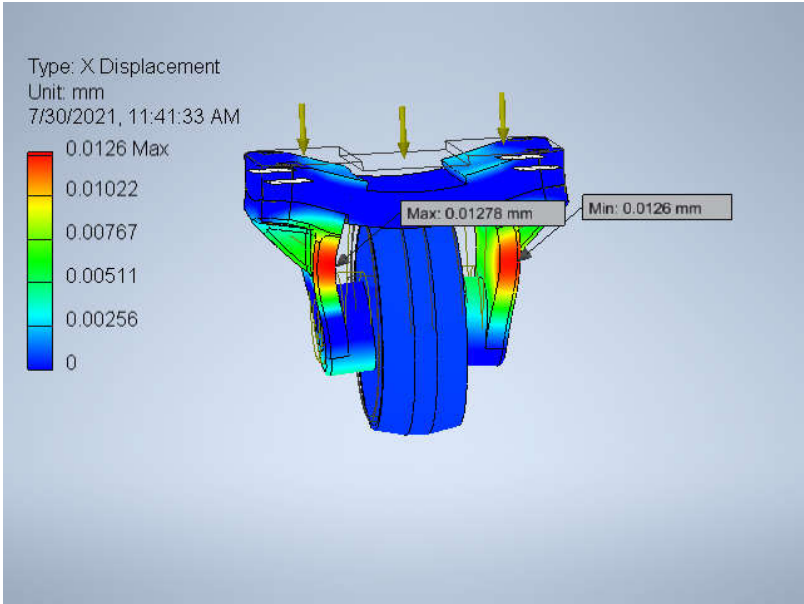




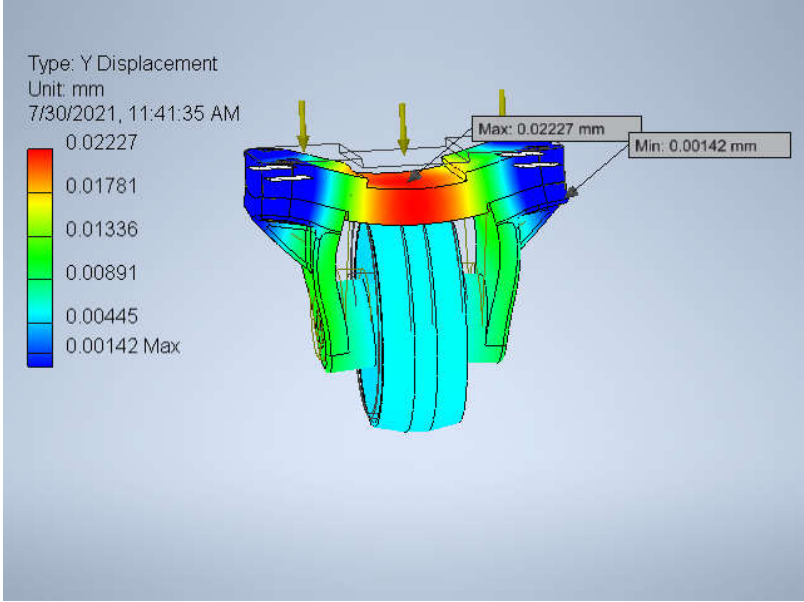
Stress ZZ

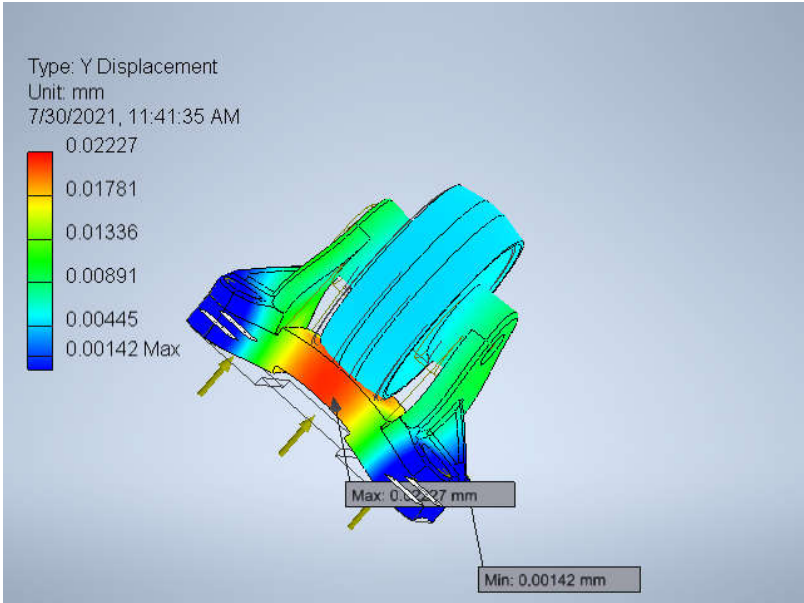


X Displacement

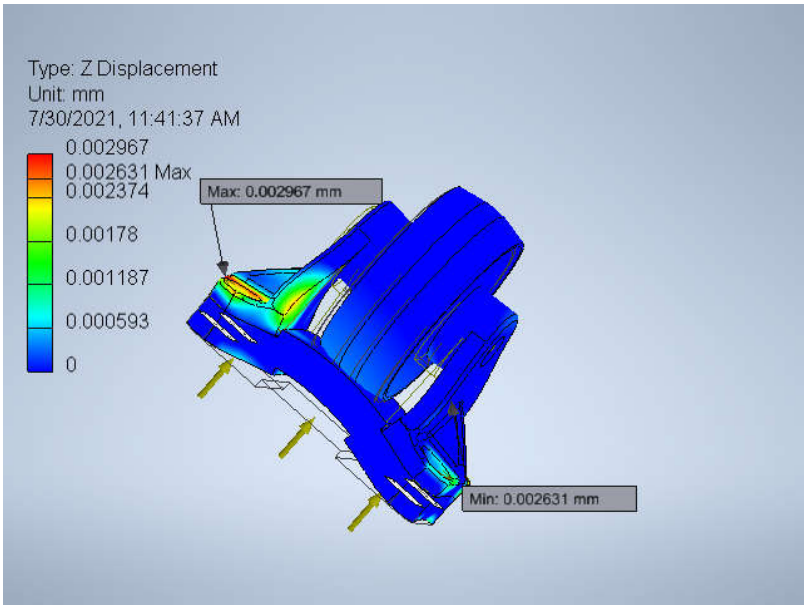
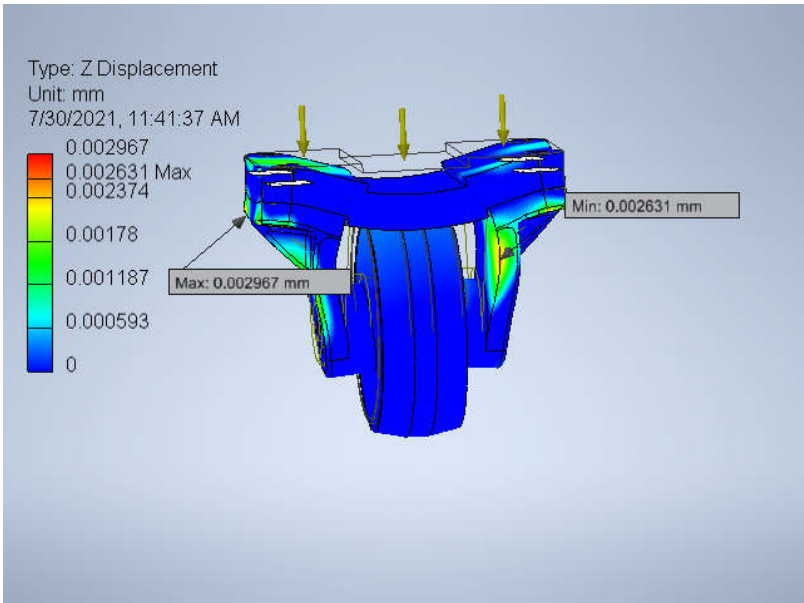


Y Displacement

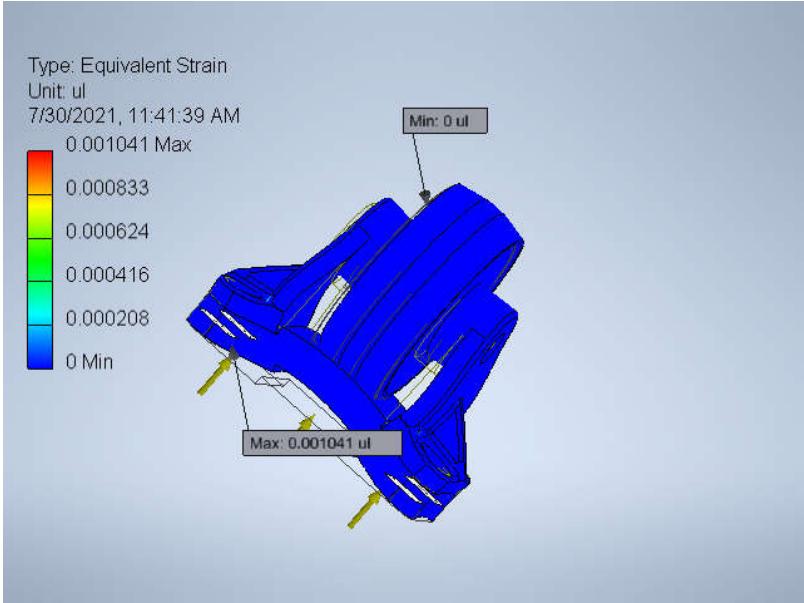
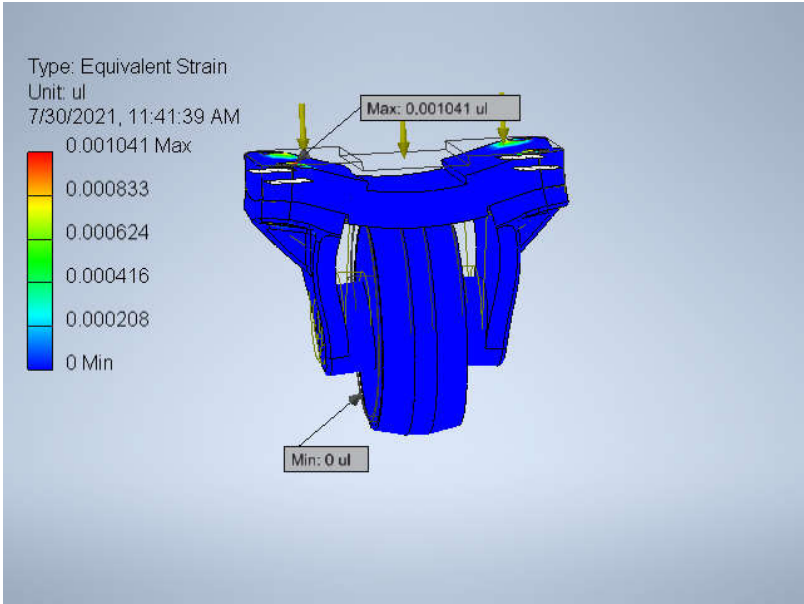




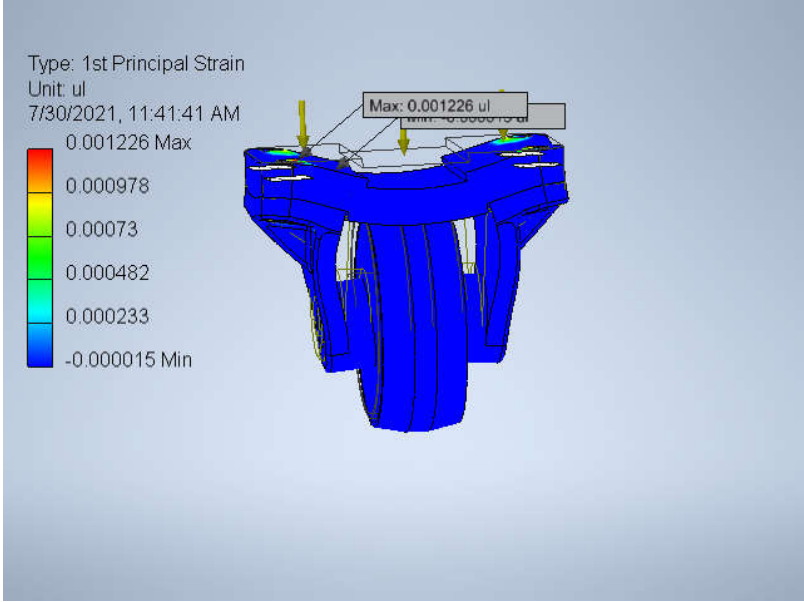
Z Displacement

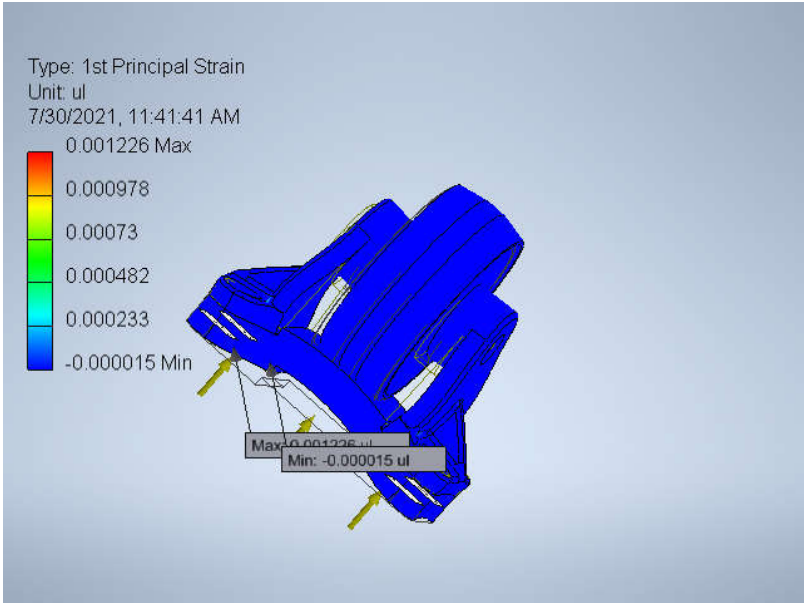


Equivalent Strain

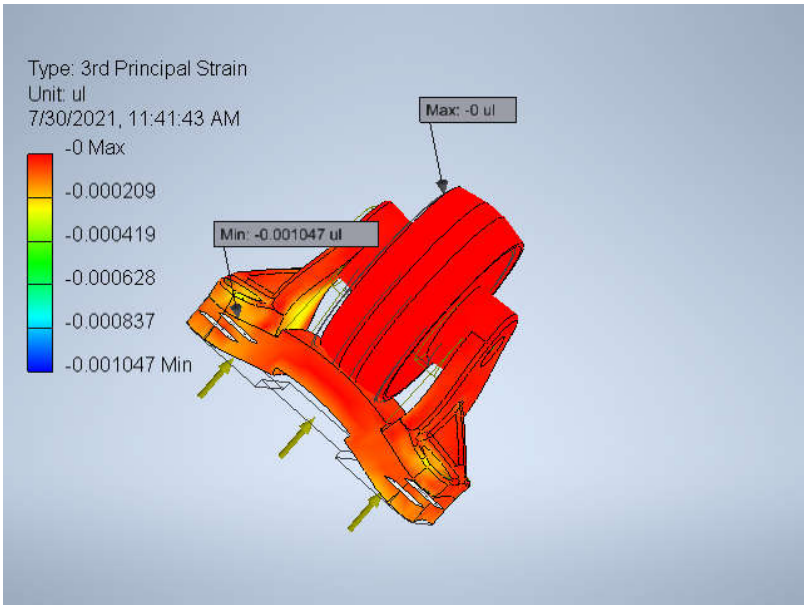
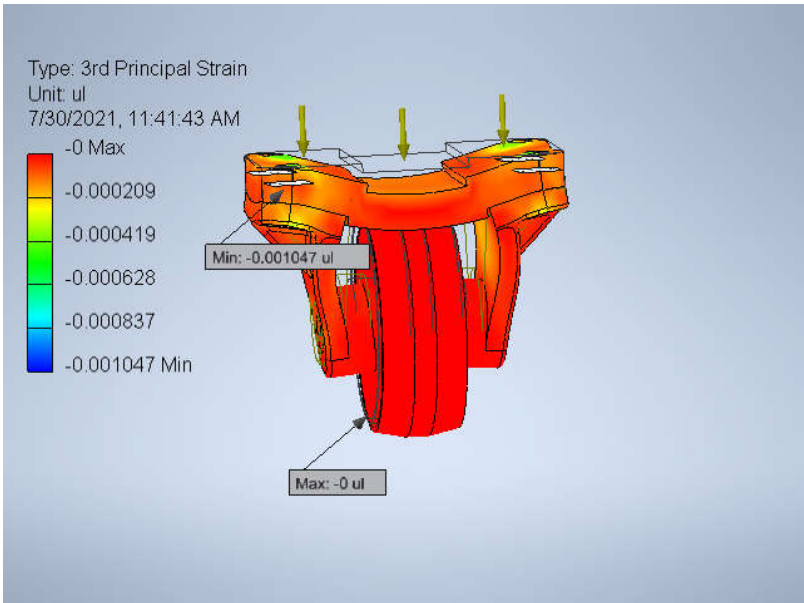


1st Principal Strain

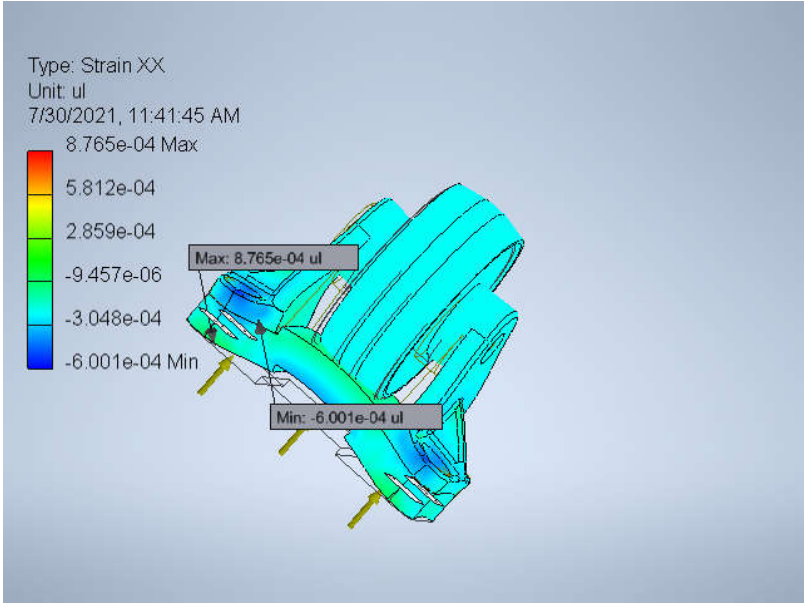
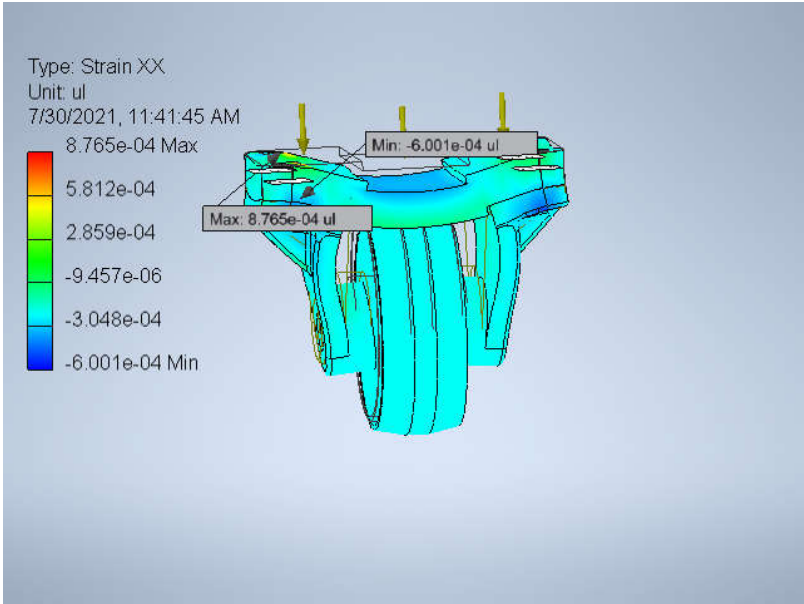




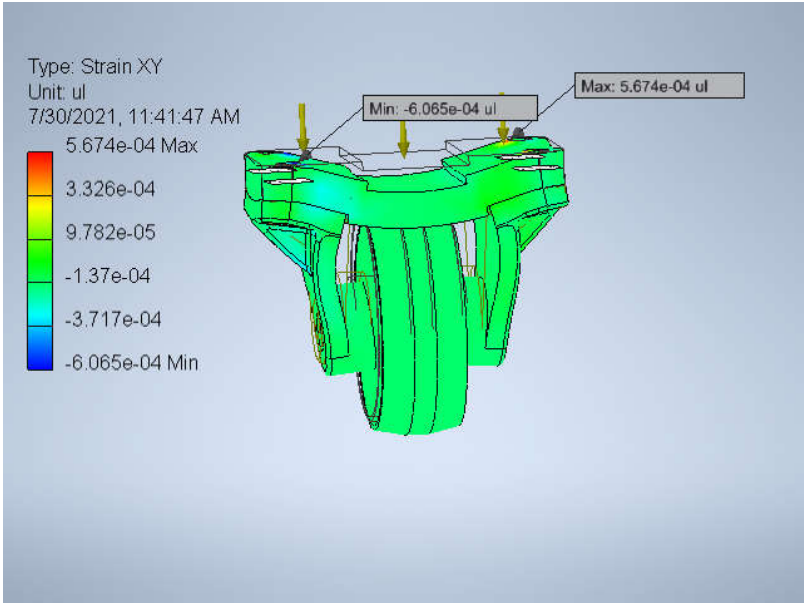
3rd Principal Strain

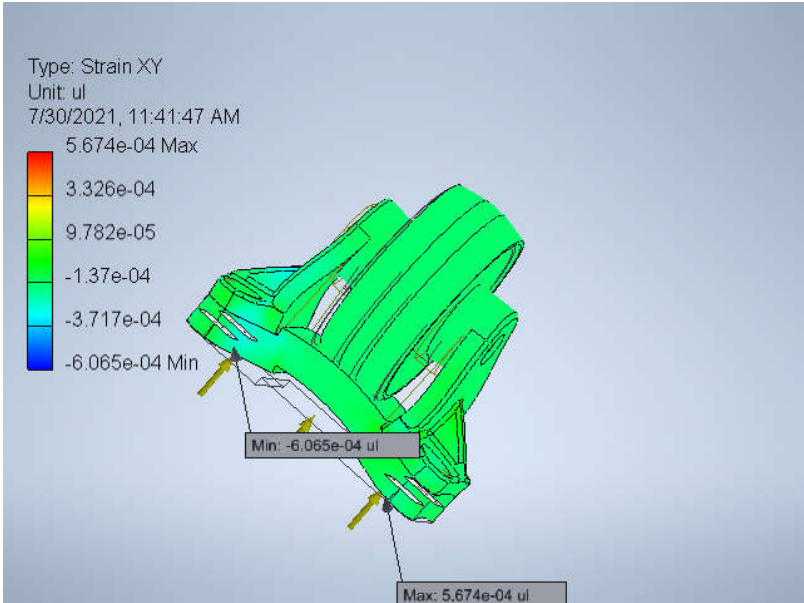


Strain XX

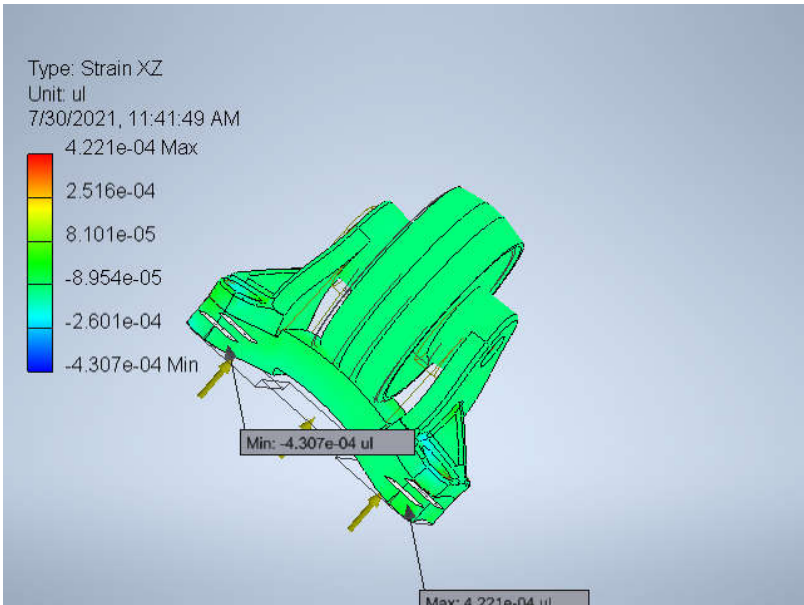
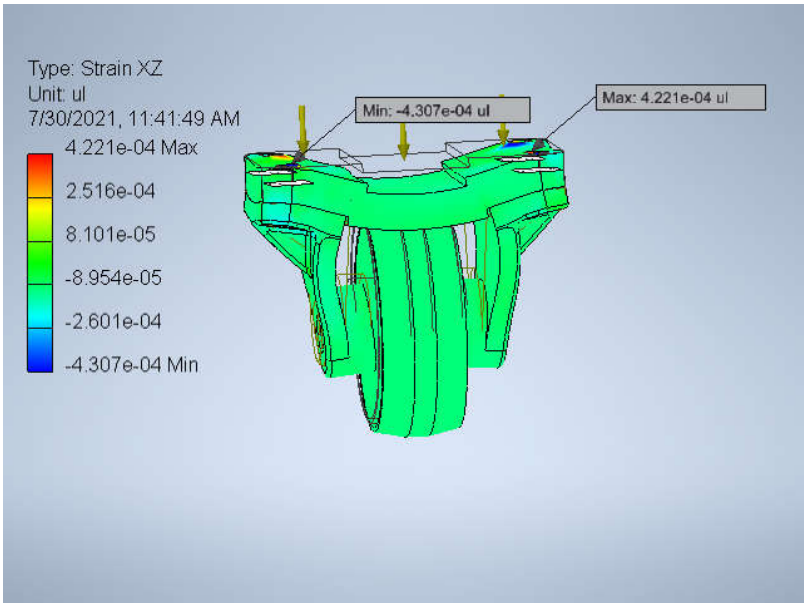


Strain XY

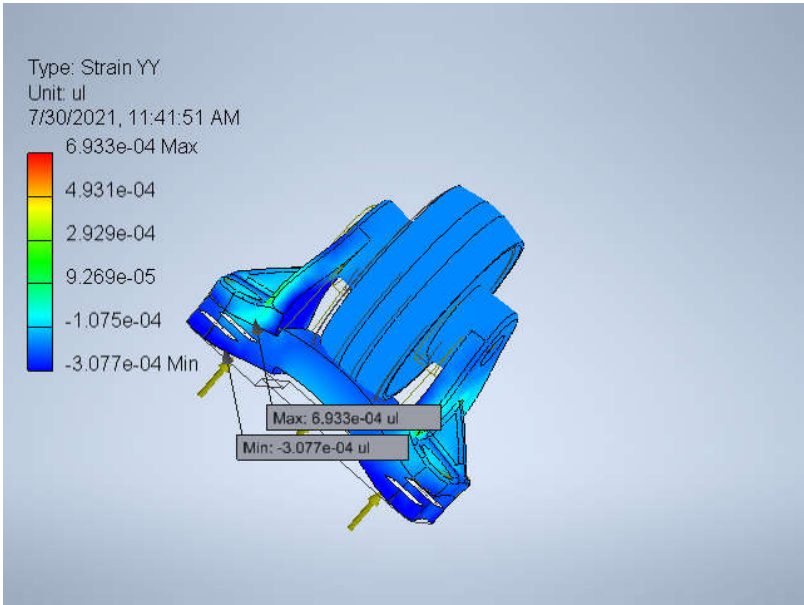
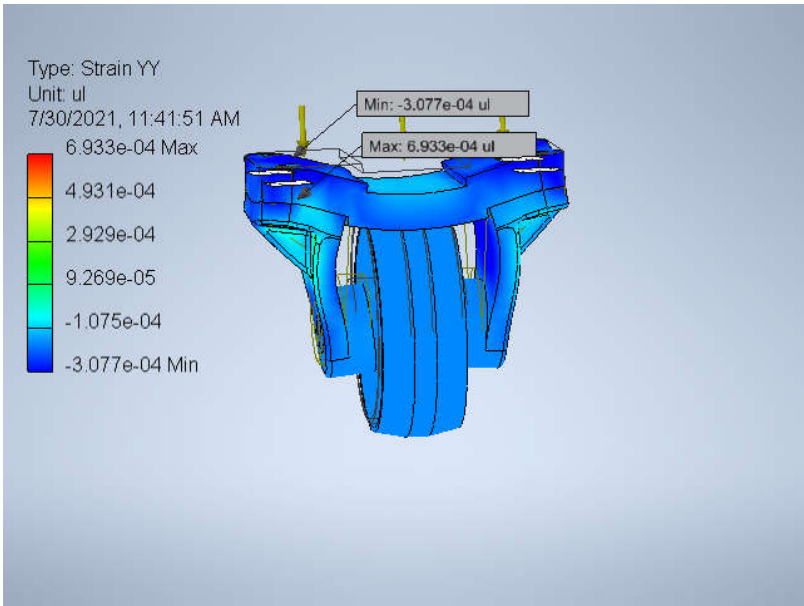




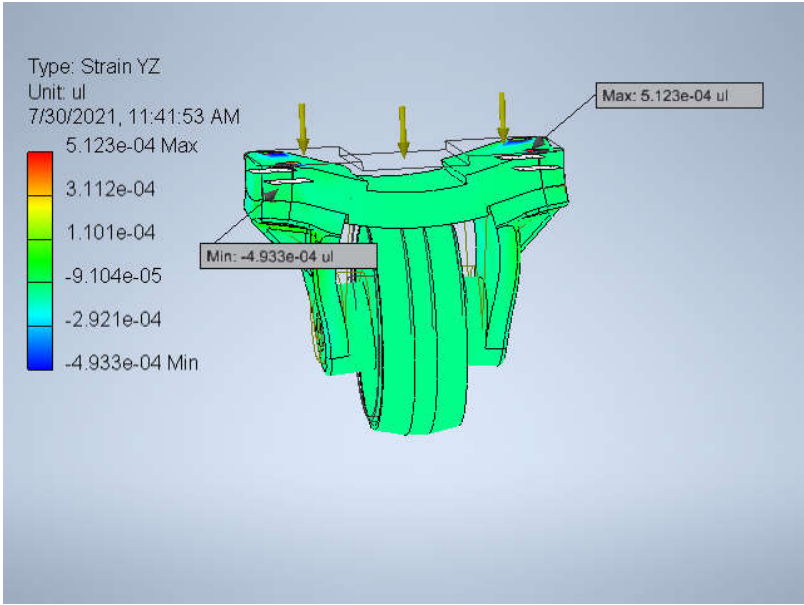
Strain XZ

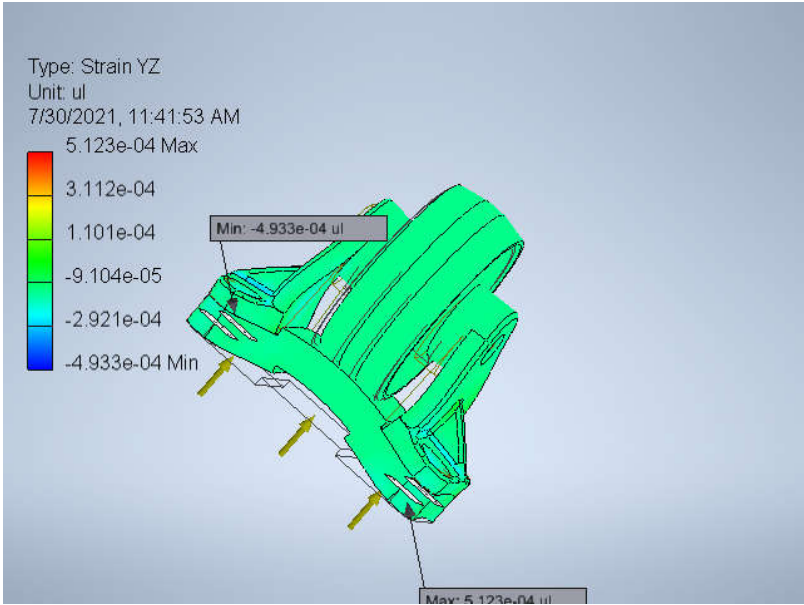


Strain YY

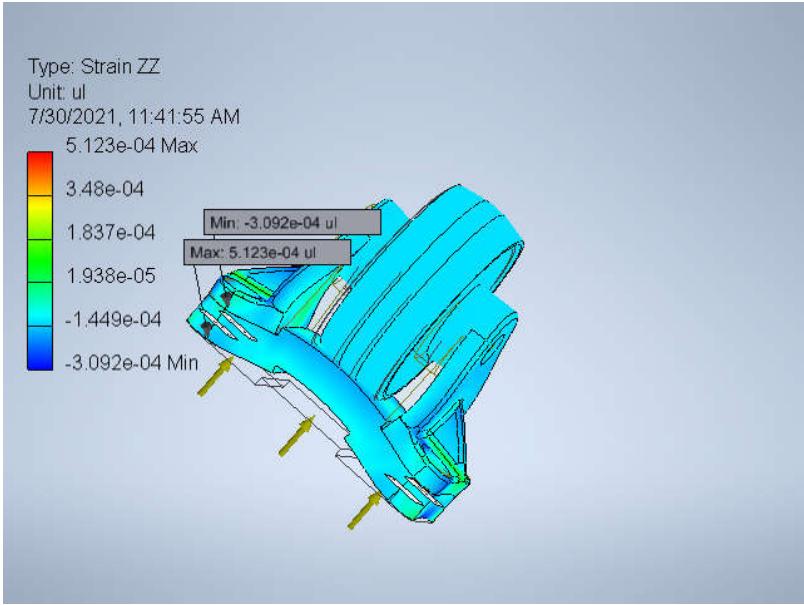
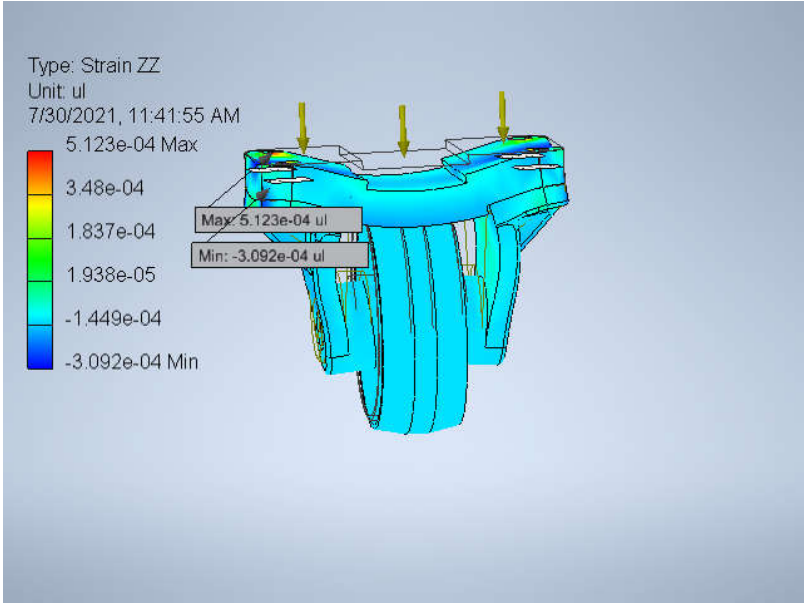


Strain YZ

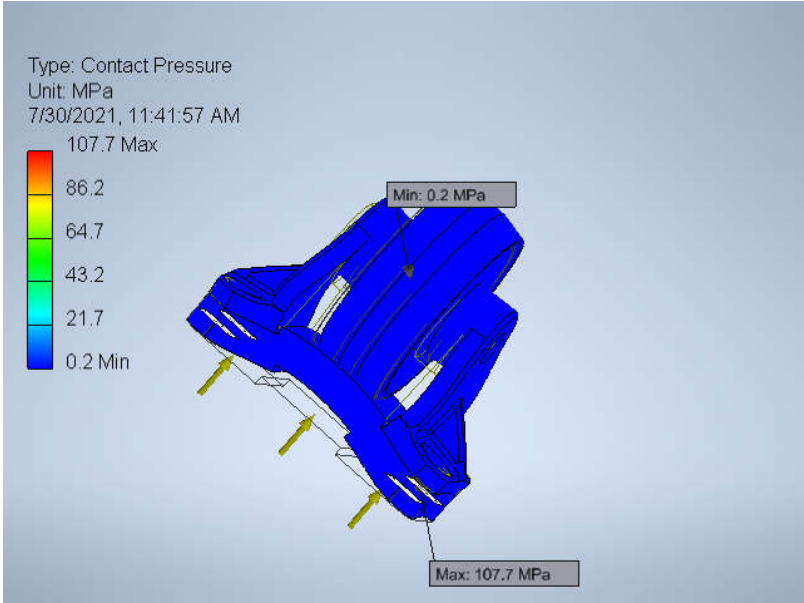
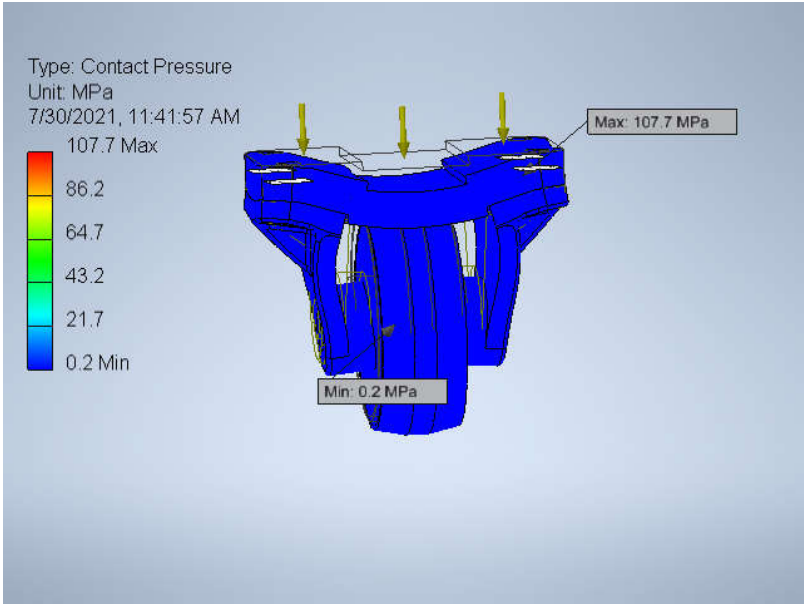




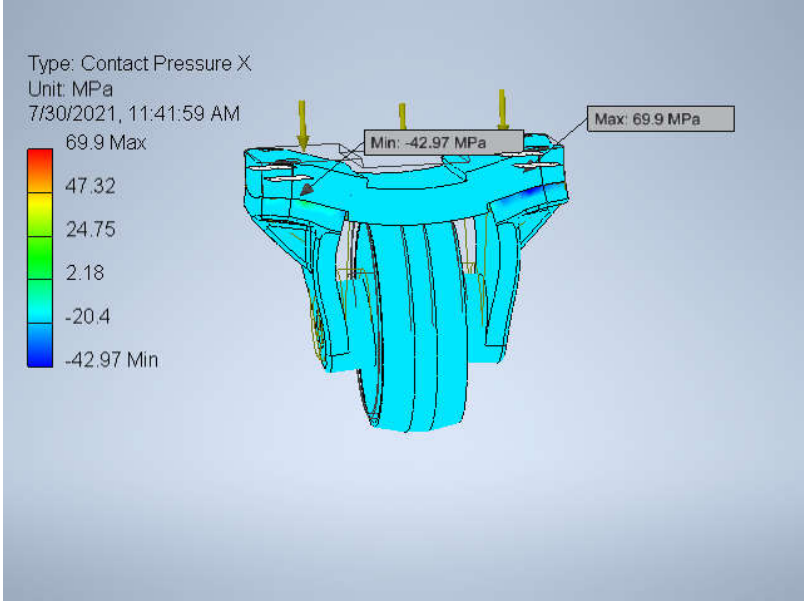
Strain ZZ

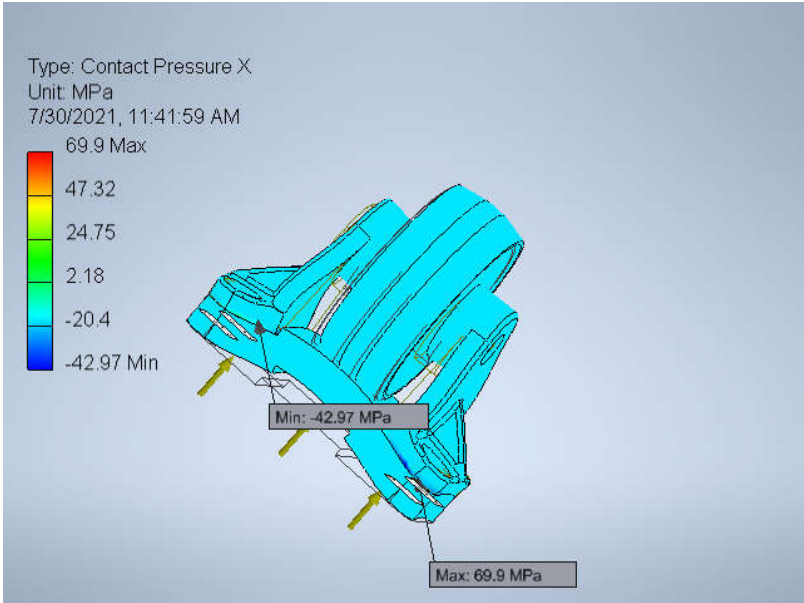


Contact Pressure

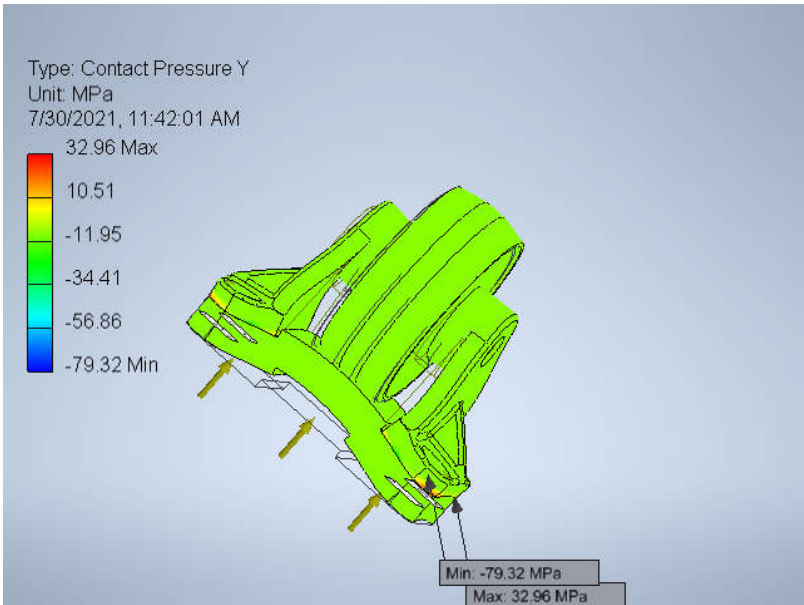
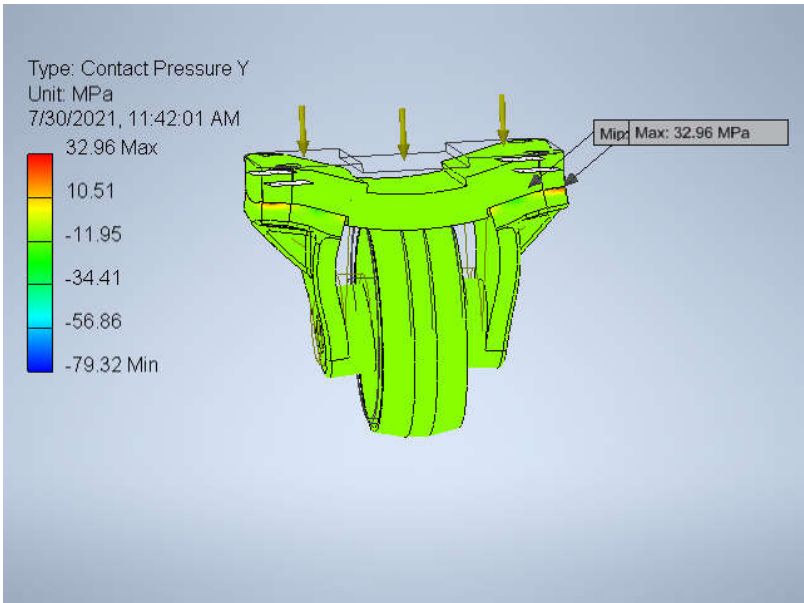


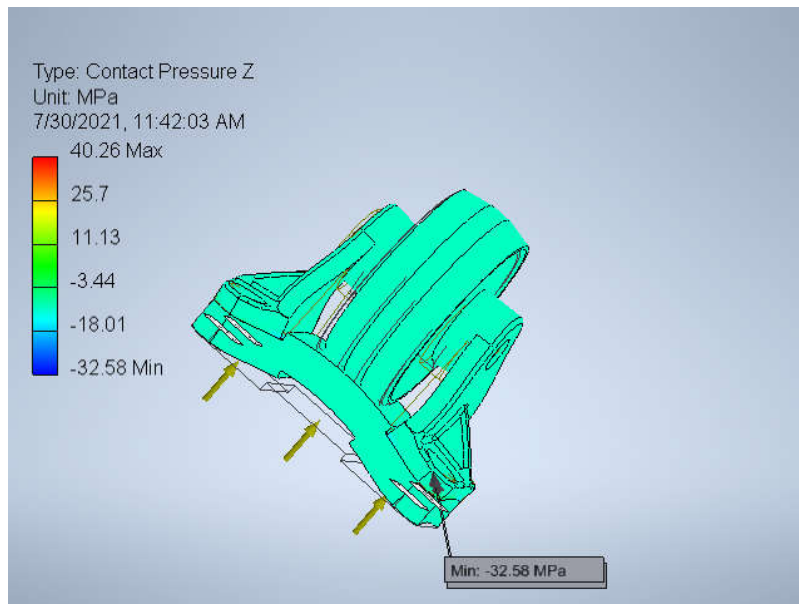
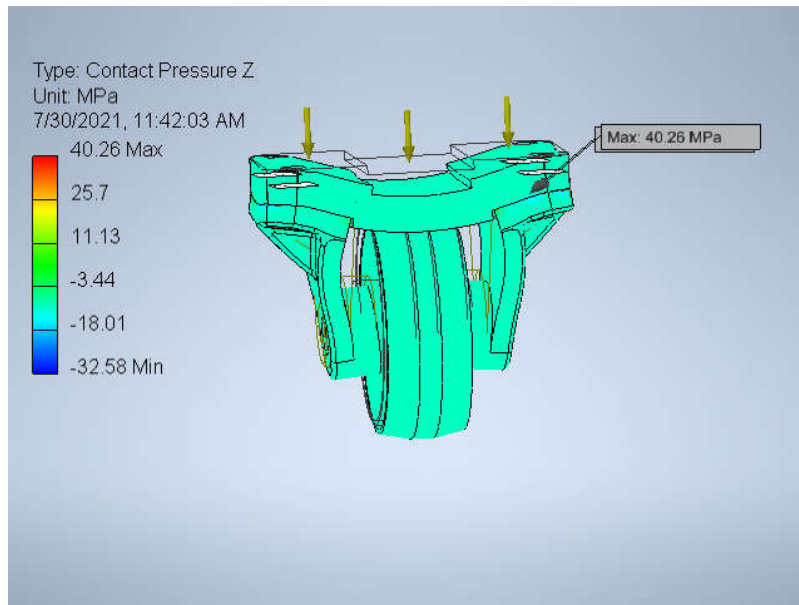
Contact Pressure X





☐ **Contact Pressure Y**



Contact Pressure Z

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