

Robo_Arm_Stress Analysis Report_5



Analyzed File:	bio-inspired-arm _1_.iam
Autodesk Inventor Version:	2023 (Build 270158000, 158)
Creation Date:	13/12/2022, 01:38
Study Author:	Rodgers O.

Static Analysis:1

General objective and settings:

Design Objective	Single Point
Study Type	Static Analysis
Last Modification Date	13/12/2022, 00:40
Model State	[Primary]
Design View	Default
Positional	[Primary]
Detect and Eliminate Rigid Body Modes	No
Separate Stresses Across Contact Surfaces	No
Motion Loads Analysis	No

iProperties

Summary

Author	Kazangyraktan
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Project

Part Number	bio-inspired-arm _1_
Designer	Kazangyraktan

Status

Design Status	WorkInProgress
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Physical

Mass	0.777136 kg
Area	279202 mm ²
Volume	626722 mm ³
Center of Gravity	x=17.391 mm y=-154.554 mm z=-333.181 mm

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

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)

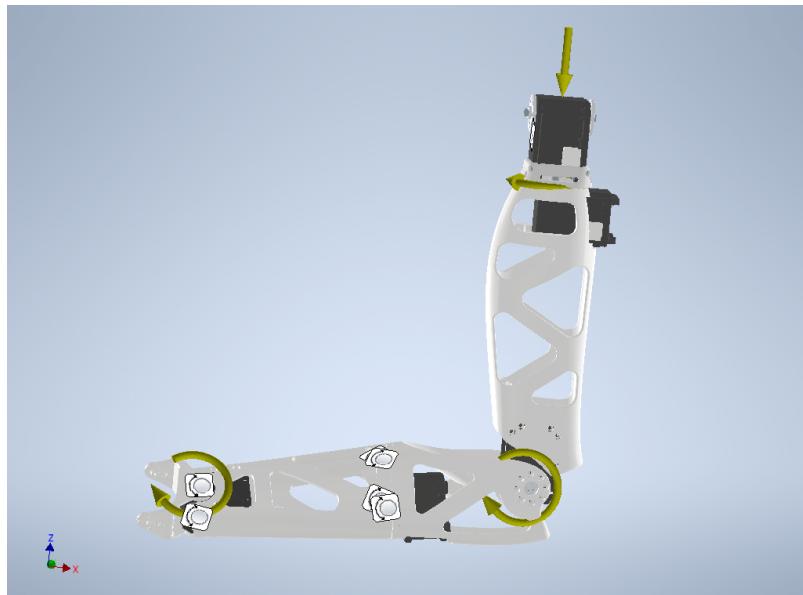
Name	PLA Plastic	
General	Mass Density	1.24 g/cm^3
	Yield Strength	60 MPa
	Ultimate Tensile Strength	50 MPa
Stress	Young's Modulus	3.5 GPa
	Poisson's Ratio	0.3 ul
	Shear Modulus	1.34615 GPa
Part Name(s)	PH Pan head screw M3x0.50 x 6.ckpt AX_body.ckpt AX12_Horn.ckpt Hex thin nut grade A & B M2.5.ckpt Hex socket head cap screw M2.5x0.45 x 8.ckpt Hex socket head cap screw M2.5x0.45 x 6.ckpt bearing_support_2.ckpt HN07-i101.ckpt bearing_needle_2.ckpt wrist.ckpt bearing_needle_1.ckpt Hex socket head cap screw M3x0.50 x 8.ckpt Shoulder2Arm.ckpt MF128ZZ.ckpt plate_1.ckpt wrist-hand.ckpt upper_arm.ckpt wrist_yaw_interface.ckpt MX-28_body.ckpt bearing_support_1.ckpt HN05-i101.ckpt HN07-N101.ckpt forearm.ckpt HN05-N101.ckpt MX-64-body.ckpt RX64-CAP.ckpt	

Operating conditions

Gravity

Load Type	Gravity
Magnitude	9810.000 mm/s^2
Vector X	92.930 mm/s^2
Vector Y	7.313 mm/s^2
Vector Z	-9809.557 mm/s^2

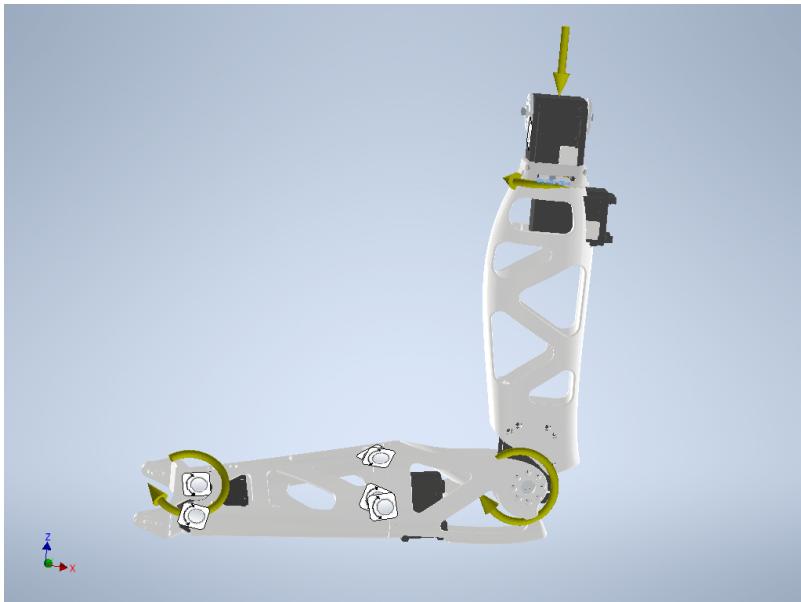
Selected Face(s)



Moment:1

Load Type	Moment
Magnitude	6000.000 N mm
Vector X	56.838 N mm
Vector Y	4.473 N mm
Vector Z	-5999.729 N mm

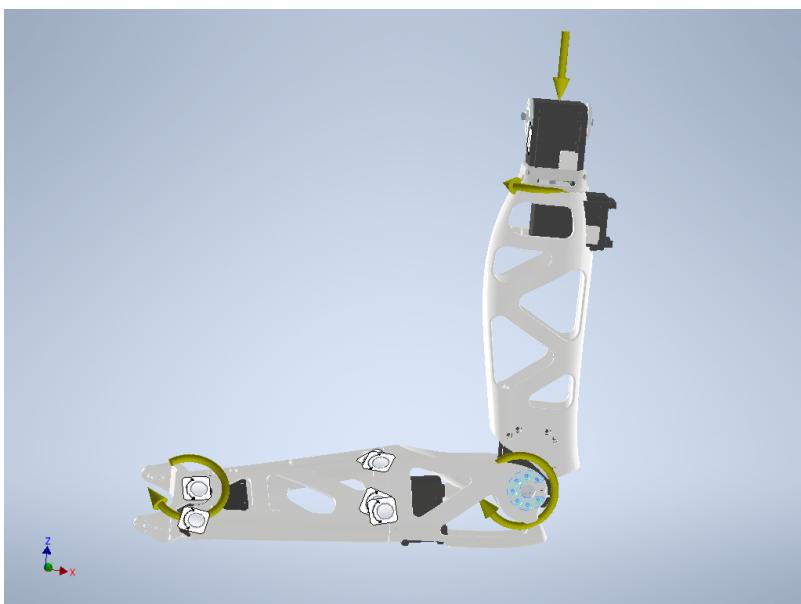
Selected Face(s)



Moment:2

Load Type	Moment
Magnitude	5000.000 N mm
Vector X	-1460.132 N mm
Vector Y	4782.040 N mm
Vector Z	-10.267 N mm

Selected Face(s)

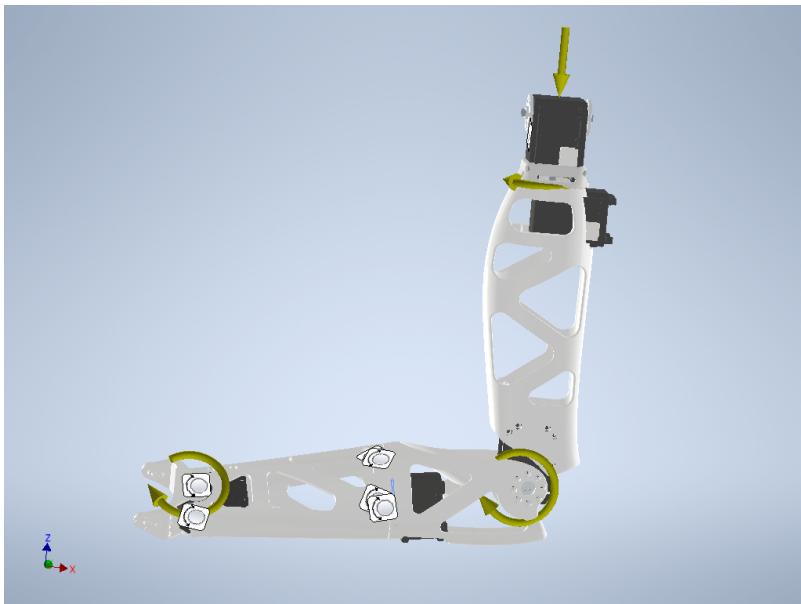


Moment:3

Load Type	Moment
Magnitude	5500.000 N mm

Vector X	-5201.103 N mm
Vector Y	-1589.846 N mm
Vector Z	-819.095 N mm

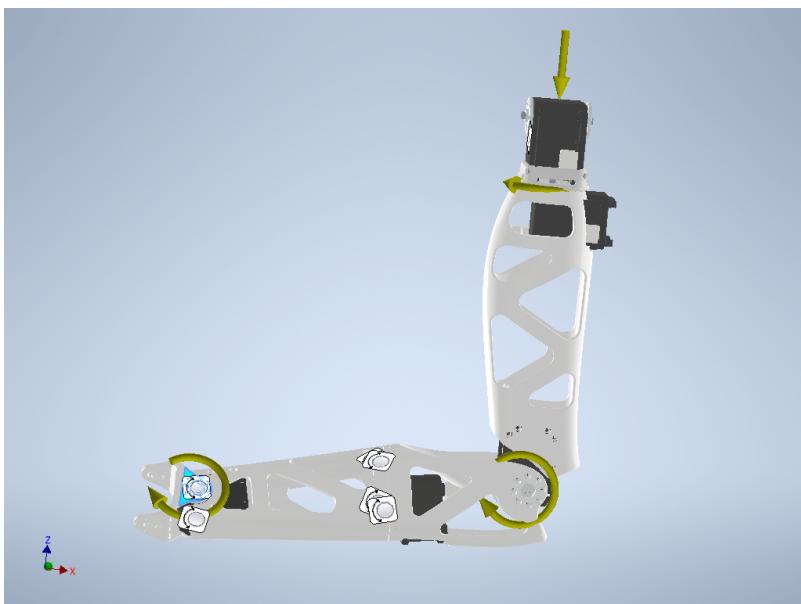
Selected Face(s)



Moment:4

Load Type	Moment
Magnitude	4000.000 N mm
Vector X	-541.442 N mm
Vector Y	3065.458 N mm
Vector Z	-2511.933 N mm

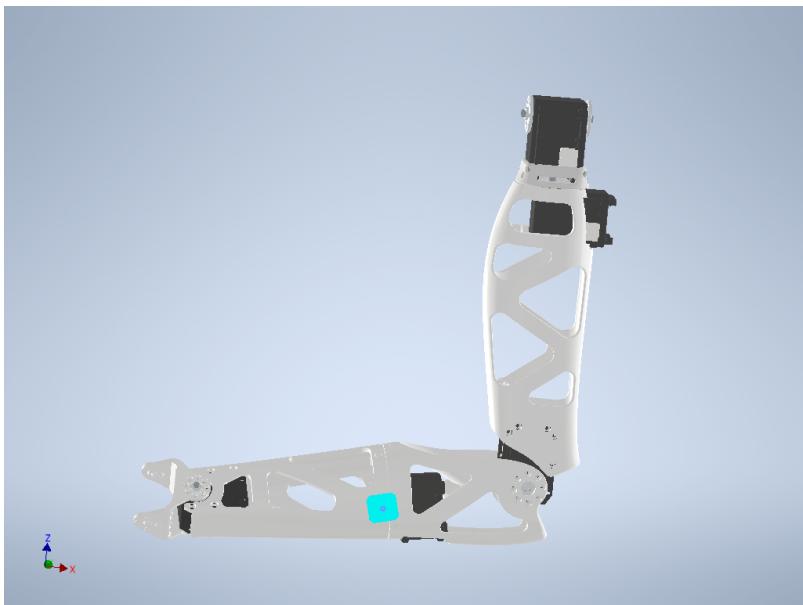
Selected Face(s)



Pin Constraint:1

Constraint Type	Pin Constraint
Fix Radial Direction	Yes
Fix Axial Direction	Yes
Fix Tangential Direction	No

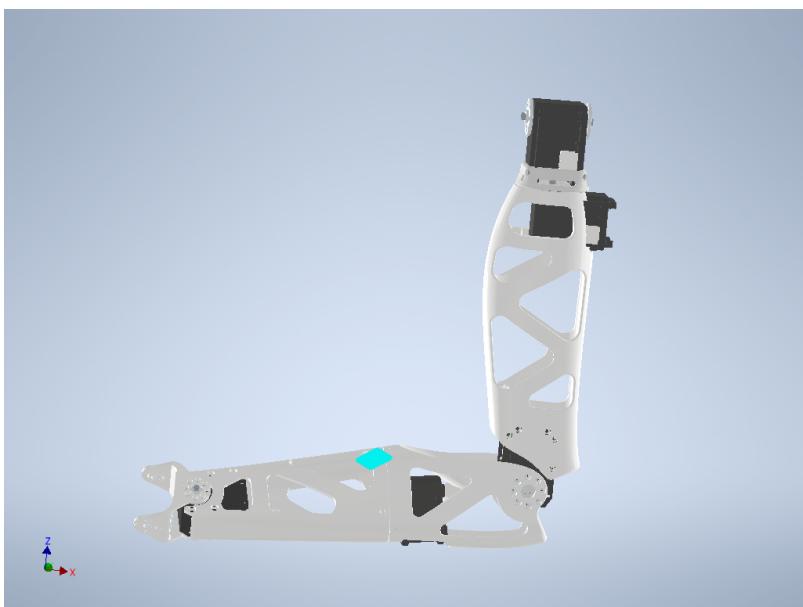
Selected Face(s)



Pin Constraint:2

Constraint Type	Pin Constraint
Fix Radial Direction	Yes
Fix Axial Direction	Yes
Fix Tangential Direction	No

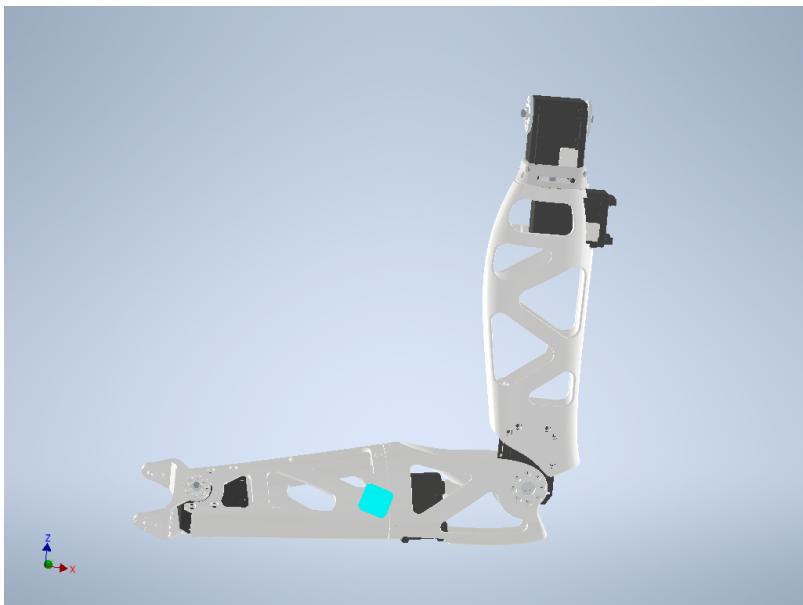
Selected Face(s)



Pin Constraint:3

Constraint Type	Pin Constraint
Fix Radial Direction	Yes
Fix Axial Direction	Yes
Fix Tangential Direction	No

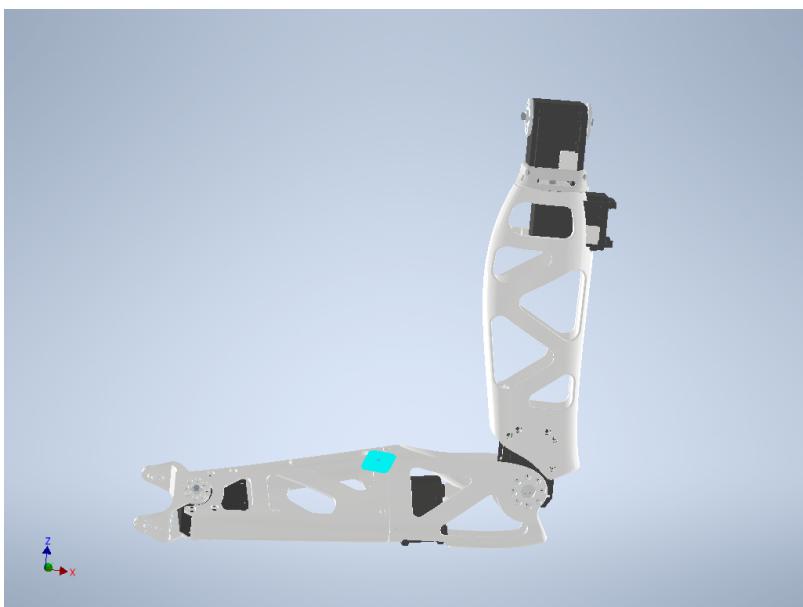
Selected Face(s)



Pin Constraint:4

Constraint Type	Pin Constraint
Fix Radial Direction	Yes
Fix Axial Direction	Yes
Fix Tangential Direction	No

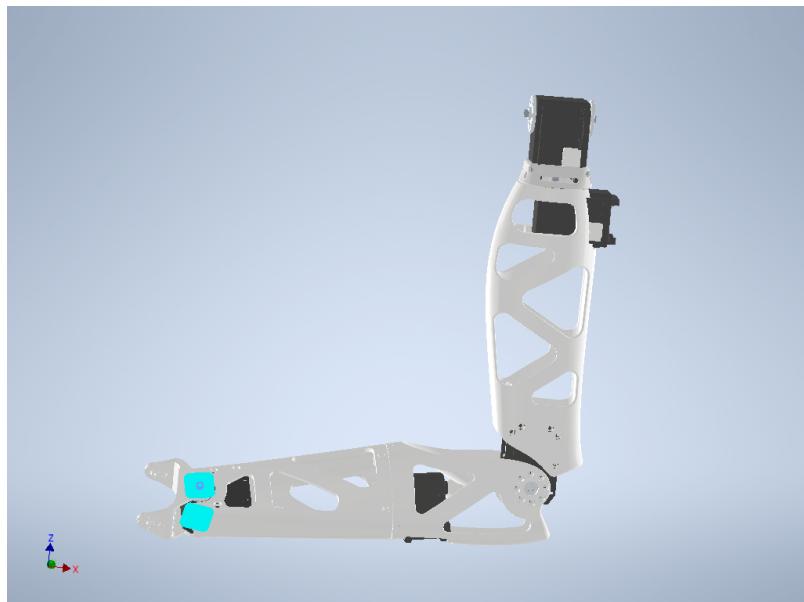
Selected Face(s)



Pin Constraint:5

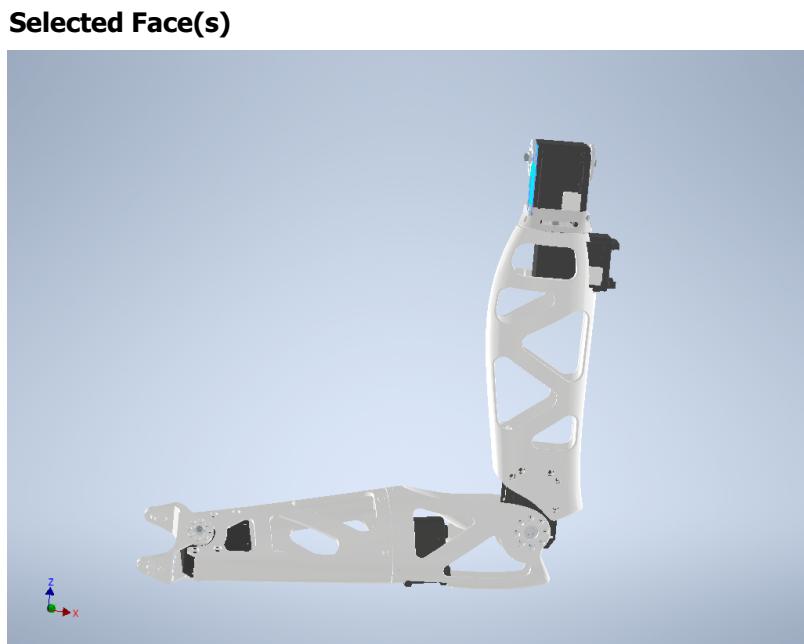
Constraint Type	Pin Constraint
Fix Radial Direction	Yes
Fix Axial Direction	Yes
Fix Tangential Direction	No

Selected Face(s)



Fixed Constraint:1

Constraint Type | Fixed Constraint



Results

Reaction Force and Moment on Constraints

Constraint Name	Reaction Force		Reaction Moment	
	Magnitude	Component (X,Y,Z)	Magnitude	Component (X,Y,Z)
Pin Constraint:1	37.5538 N	29.1393 N	0.0233953 N m	0.0222529 N m
		11.0476 N		0.00705549 N m
		20.9557 N		-0.00153945 N m
Pin Constraint:2	40.3491 N	-39.2412 N	0.0436201 N m	0.0317003 N m
		-6.20007 N		0.0294204 N m
		-7.05229 N		-0.00567829 N m
Pin Constraint:3	13.51 N	11.1684 N	3.83106 N m	3.56798 N m
		3.05105 N		1.34896 N m
		-6.96262 N		0.356077 N m

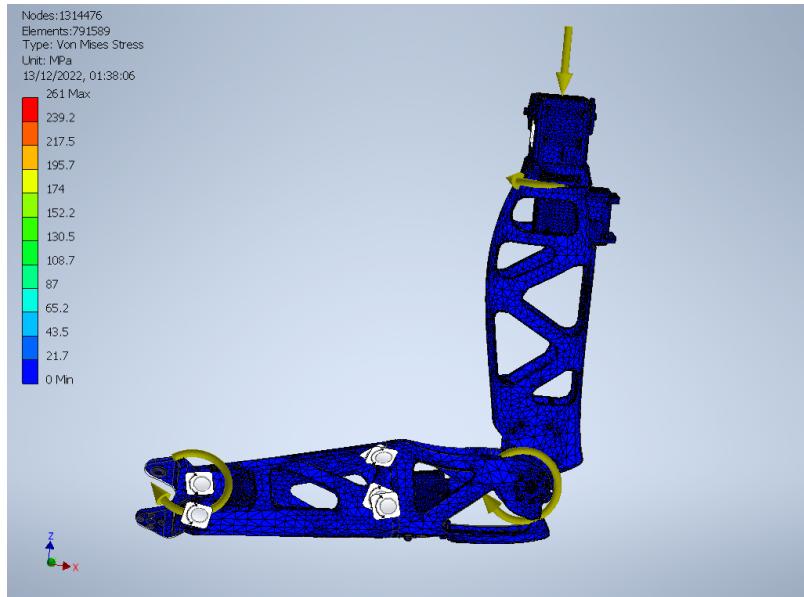
Pin Constraint:4	5.21994 N	-3.41452 N	0.00394264 N m	0.00318738 N m
		-3.00494 N		-0.00201064 N m
		-2.56108 N		-0.00115859 N m
Pin Constraint:5	18.4331 N	14.2263 N	0.518894 N m	0.499156 N m
		-2.96235 N		0.131512 N m
		-11.3409 N		0.0529025 N m
Fixed Constraint:1	17.5959 N	-12.0173 N	6.27918 N m	0.375693 N m
		-3.24735 N		0.158822 N m
		12.4361 N		6.26592 N m

Result Summary

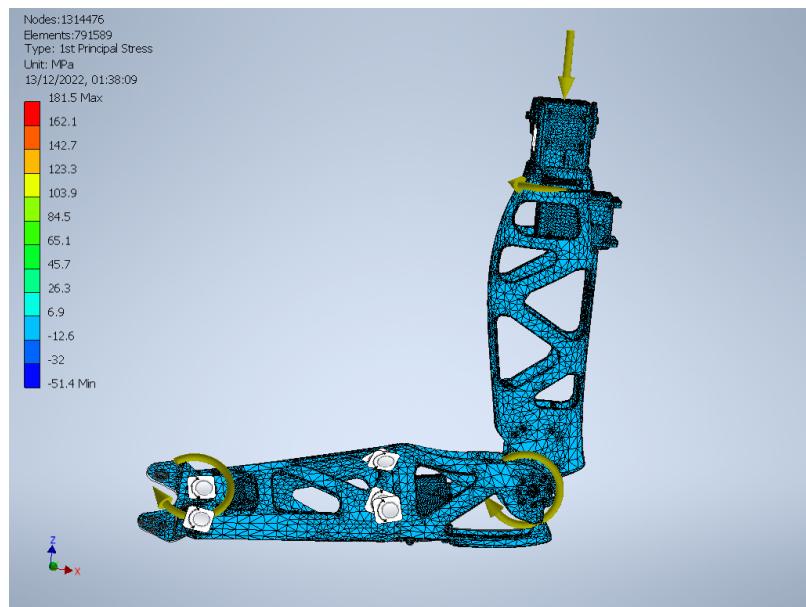
Name	Minimum	Maximum
Volume	626759 mm ³	
Mass	0.777182 kg	
Von Mises Stress	0.000000592268 MPa	260.999 MPa
1st Principal Stress	-51.3705 MPa	181.546 MPa
3rd Principal Stress	-313.136 MPa	32.0858 MPa
Displacement	0 mm	1.88679 mm
Safety Factor	0.229886 ul	15 ul
Stress XX	-104.18 MPa	88.3902 MPa
Stress XY	-62.3905 MPa	65.4409 MPa
Stress XZ	-67.5101 MPa	96.721 MPa
Stress YY	-160.024 MPa	111.429 MPa
Stress YZ	-70.0323 MPa	111.593 MPa
Stress ZZ	-211.287 MPa	158.958 MPa
X Displacement	-1.0009 mm	0.841296 mm
Y Displacement	-0.792401 mm	1.07813 mm
Z Displacement	-0.942889 mm	1.33421 mm

Figures

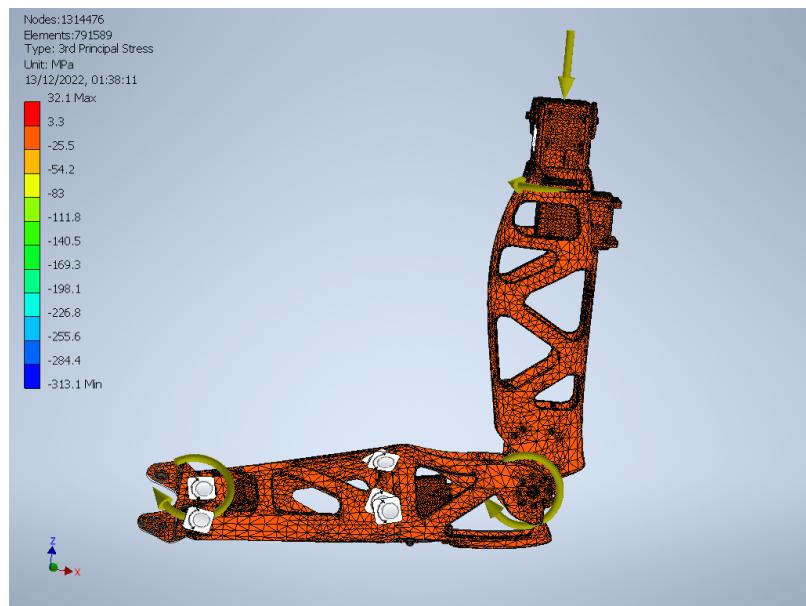
Von Mises Stress



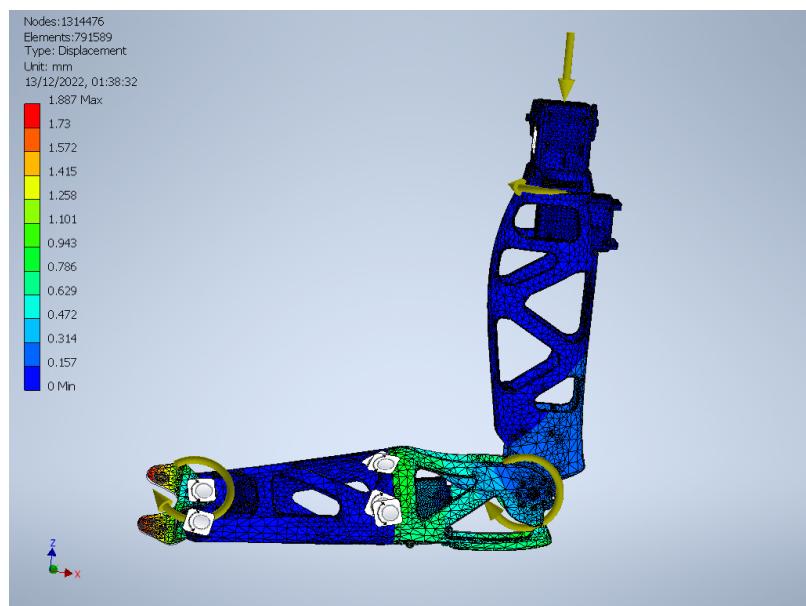
1st Principal Stress



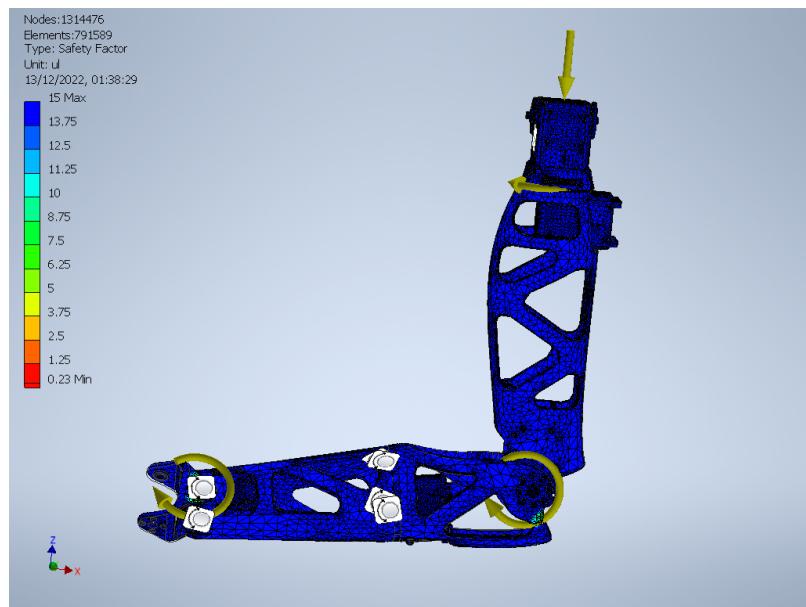
3rd Principal Stress



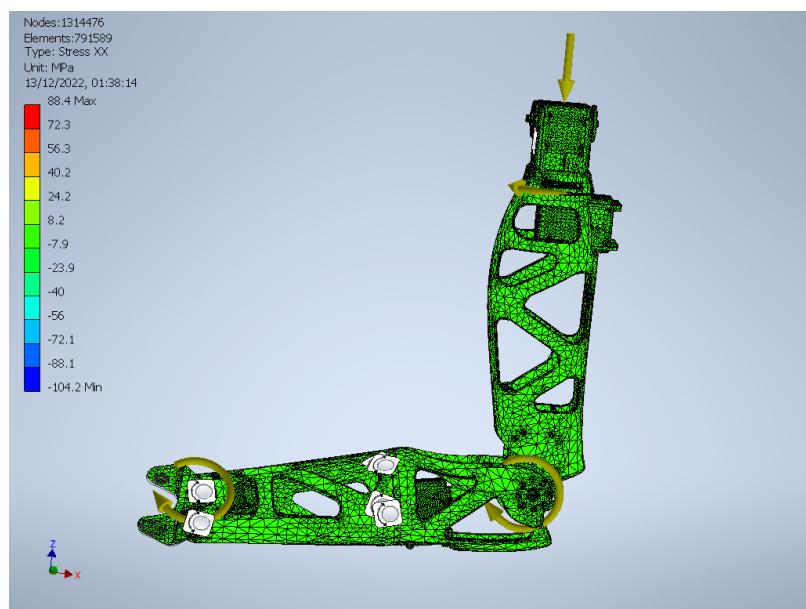
Displacement



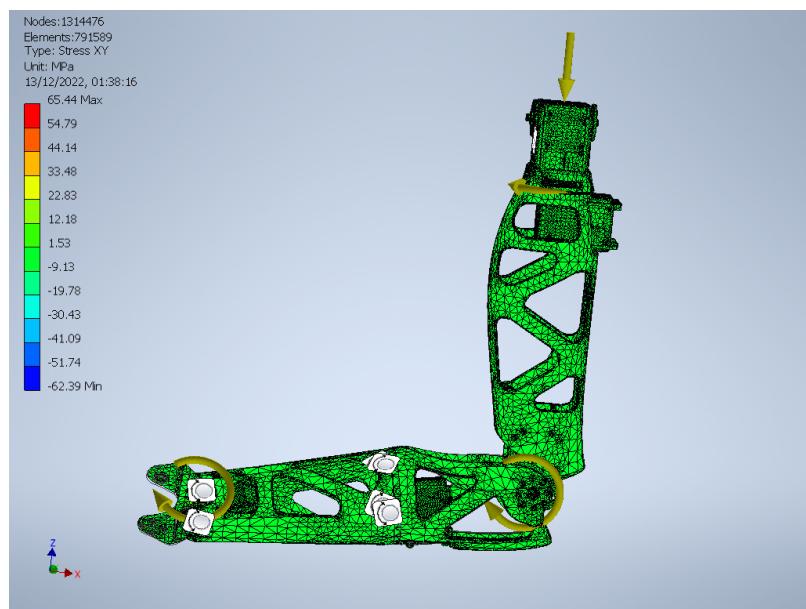
Safety Factor



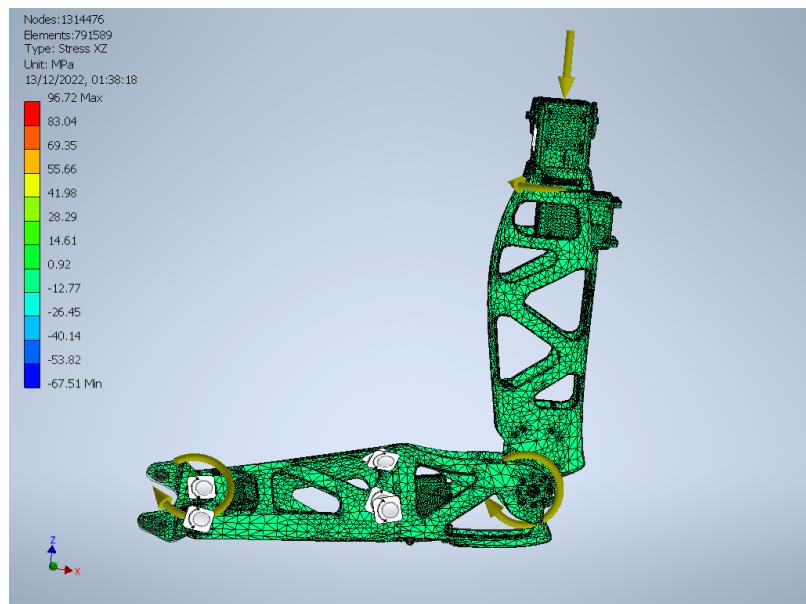
Stress XX



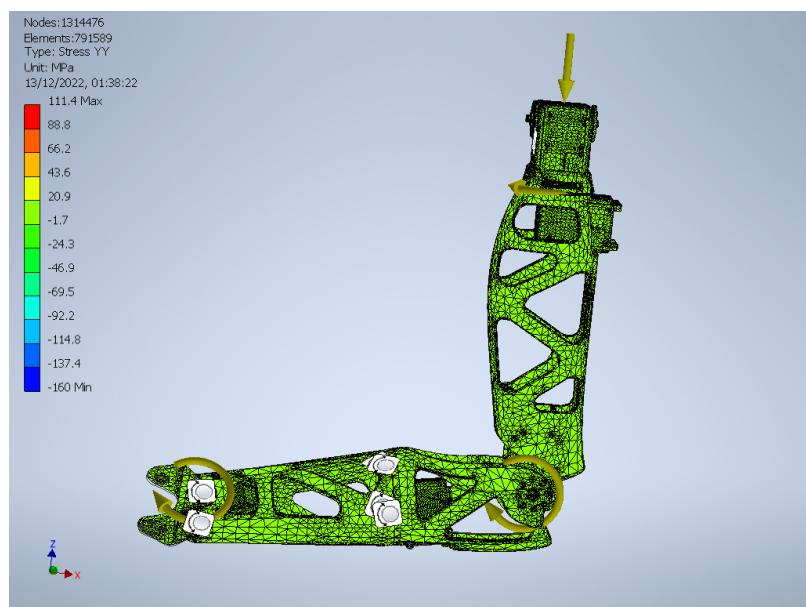
Stress XY



Stress XZ



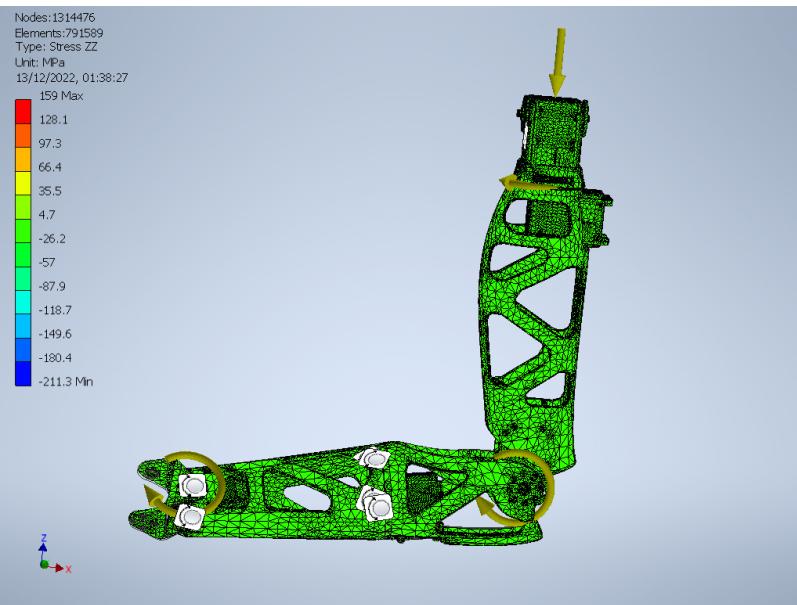
Stress YY



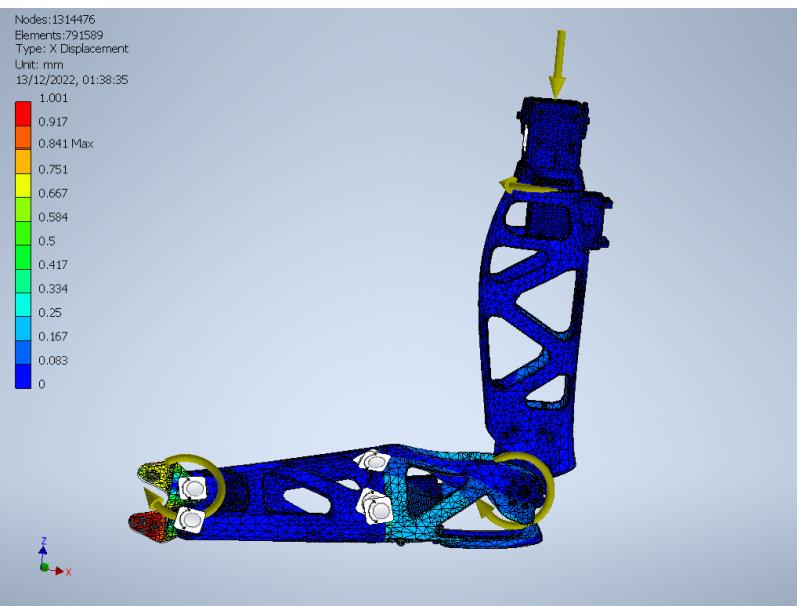
Stress YZ



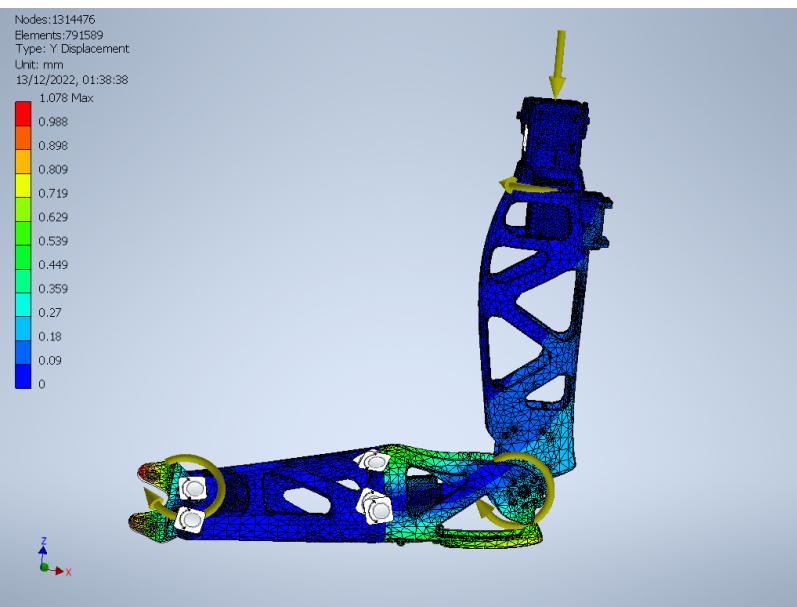
Stress ZZ



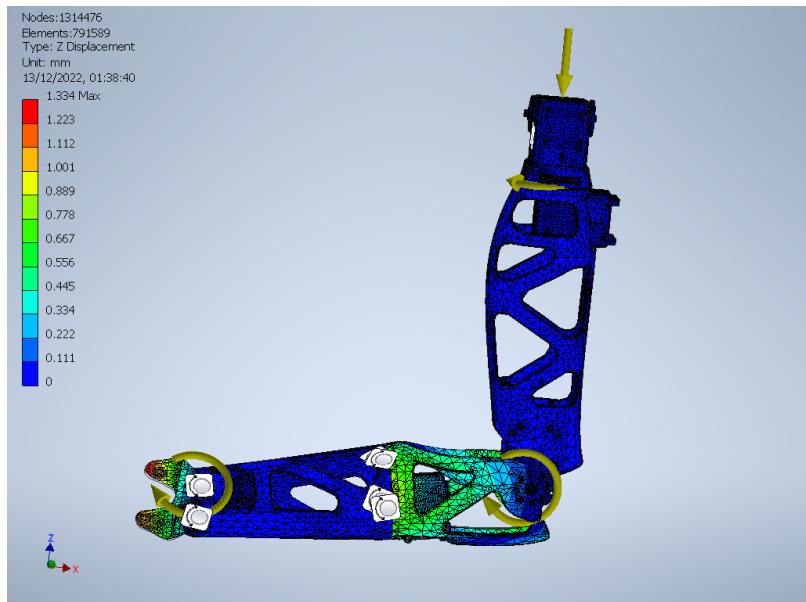
X Displacement



Y Displacement



Z Displacement



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