WENXUAN ZHANG'S PORTFOLIO

EDSGN 468 Engineering Design and Analysis with Advanced CAD
Section: 5

Wenxuan Zhang's Portfolio
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Submitted to Xinli Wu
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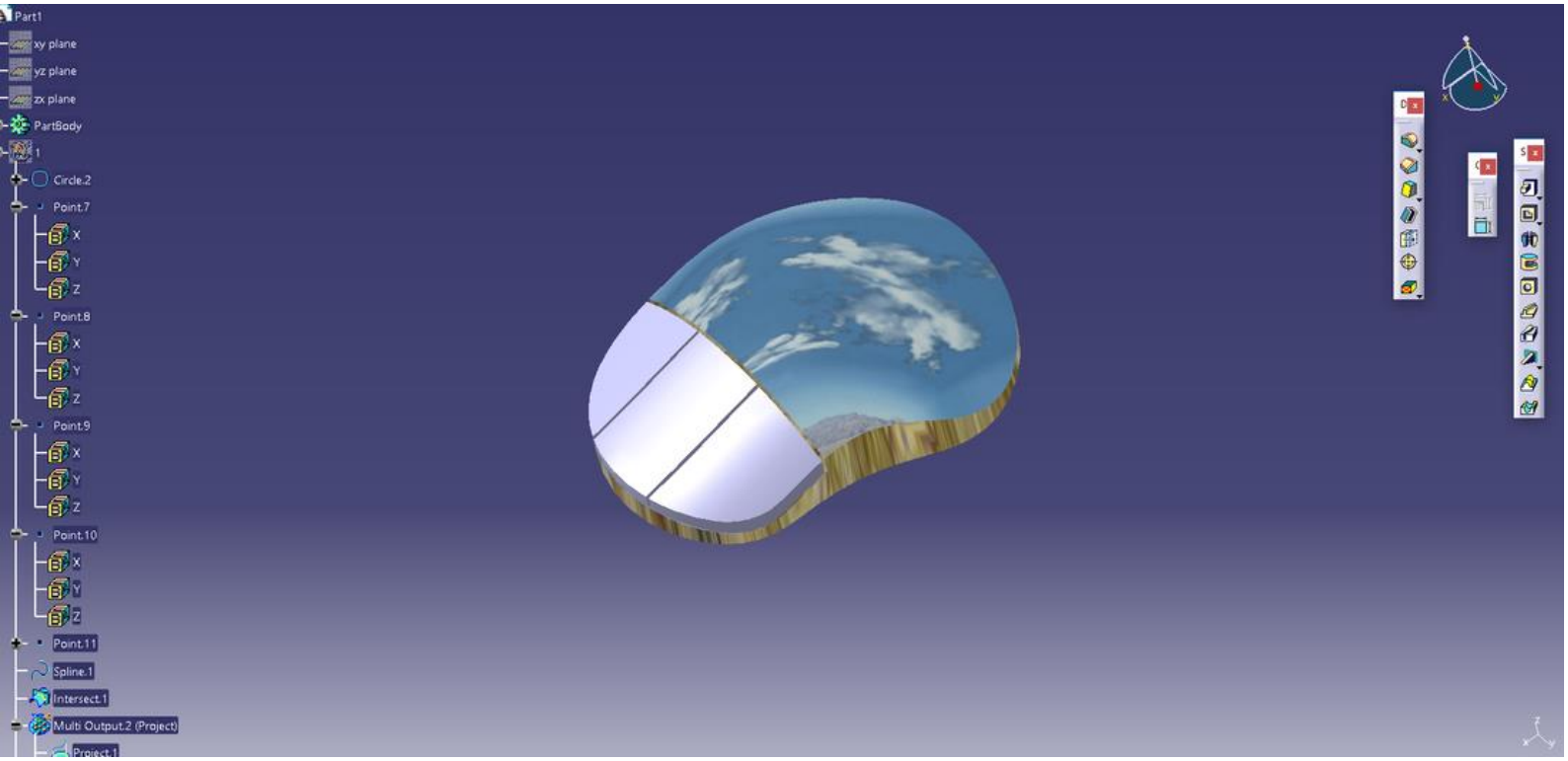
Date of Submission:
12/6/2018

ABOUT ME

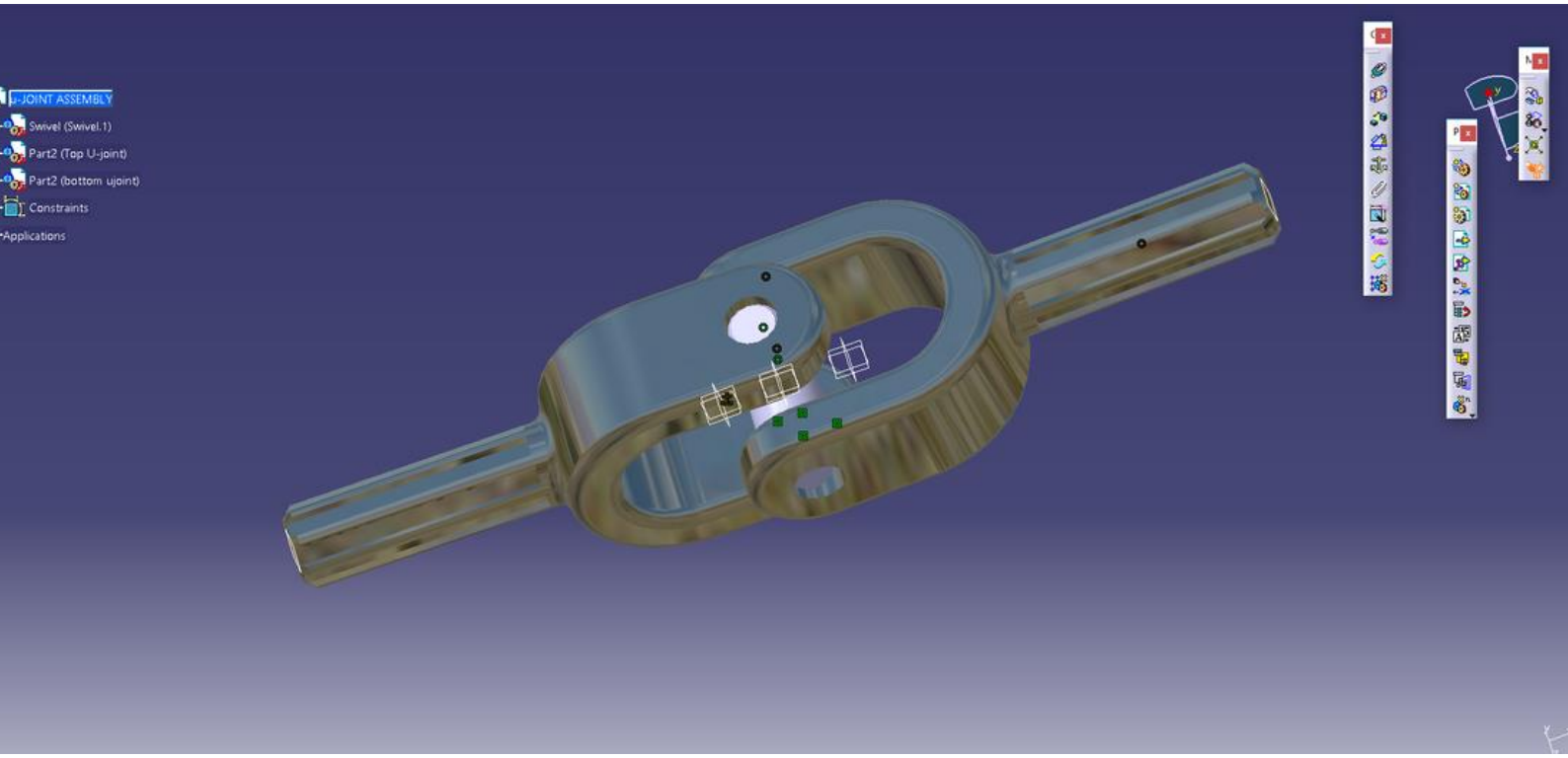
CATIA Designer

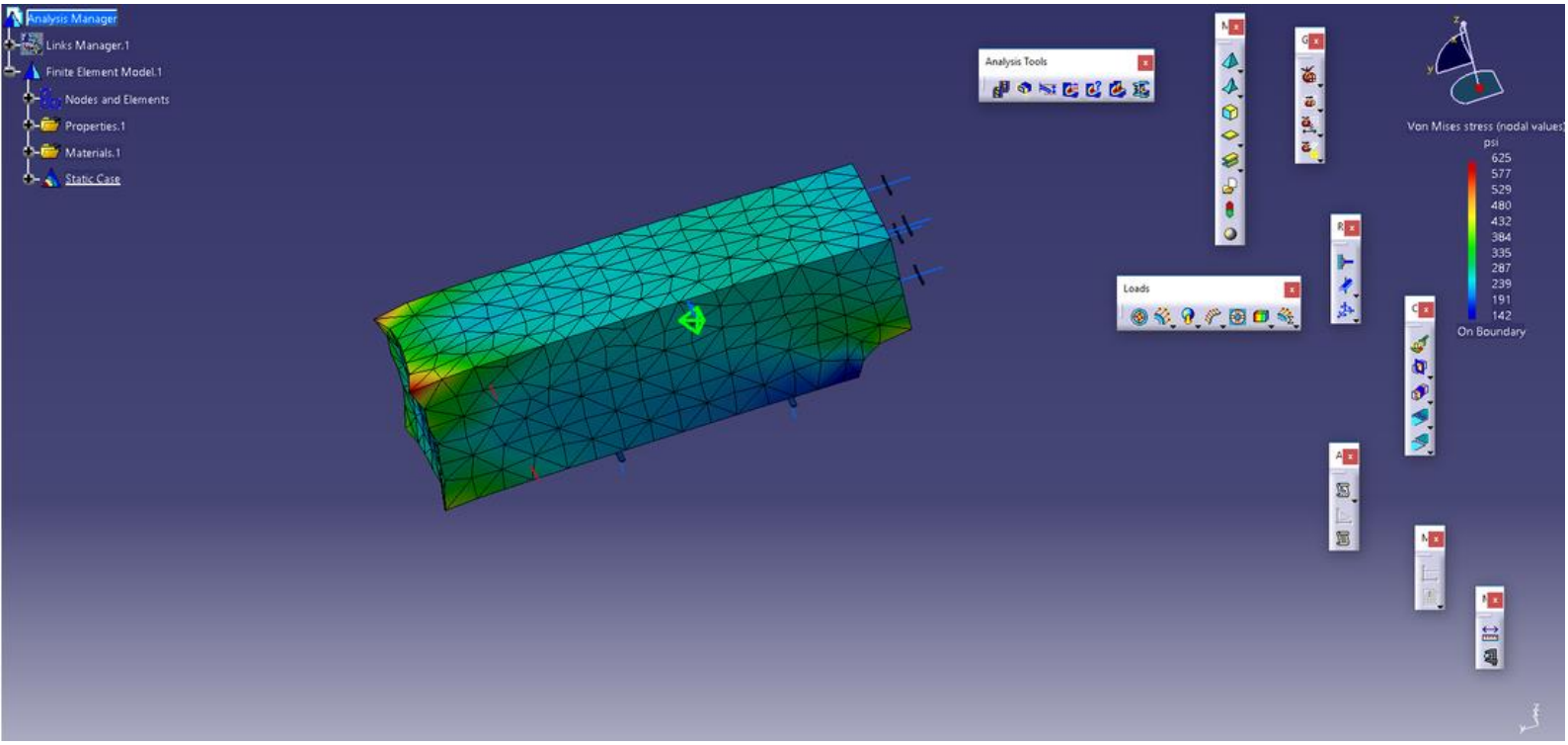
My name is Wenxuan Zhang. I am a student from Penn State majoring in Mechanical Engineering. This website is my portfolio about EDSGN 468 course. This course is Engineering Design and Analysis with Advanced CAD. We used CATIA to build model and to run stress analysis. I hope you can enjoy my portfolio. Thanks for watching !

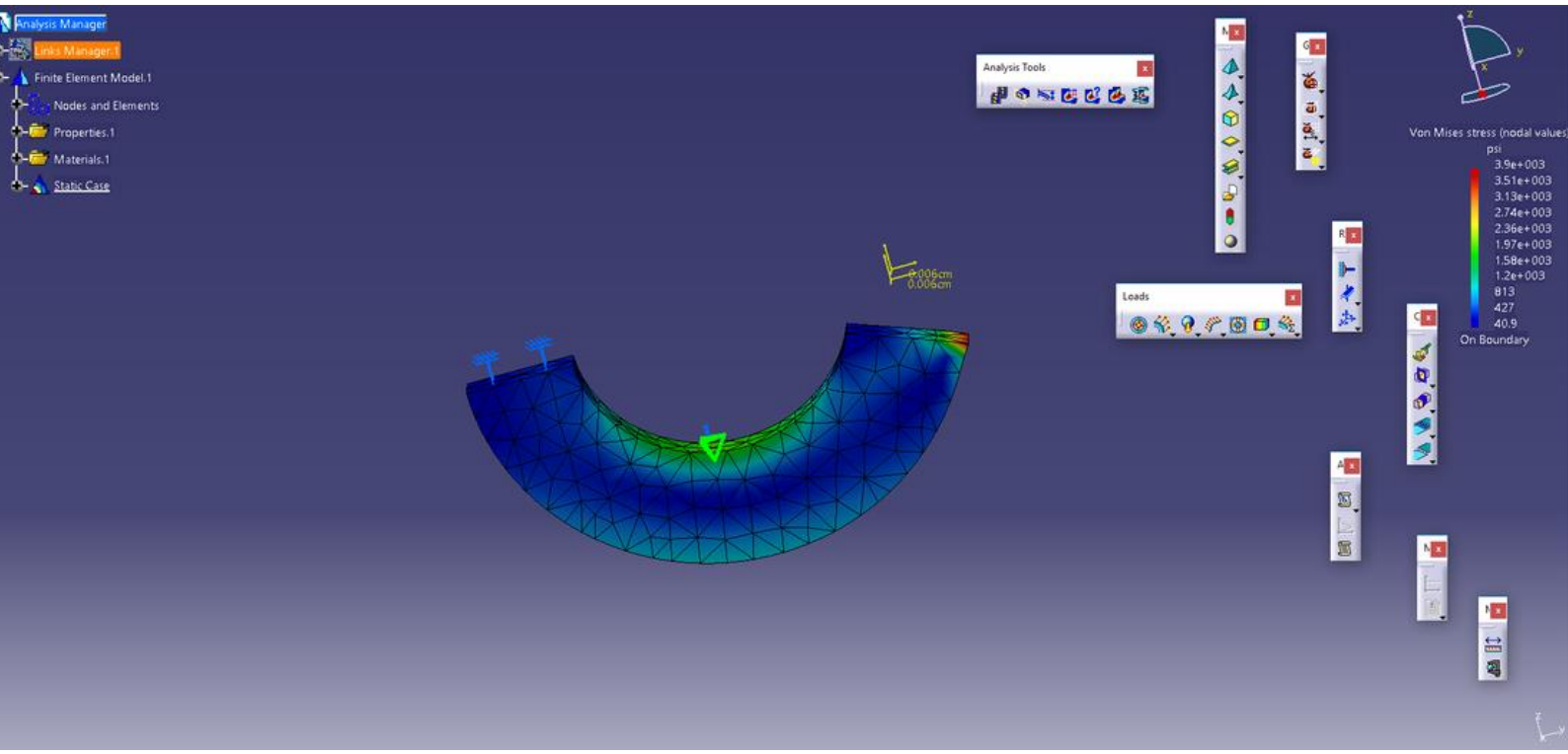

Practice Problems And Exercises

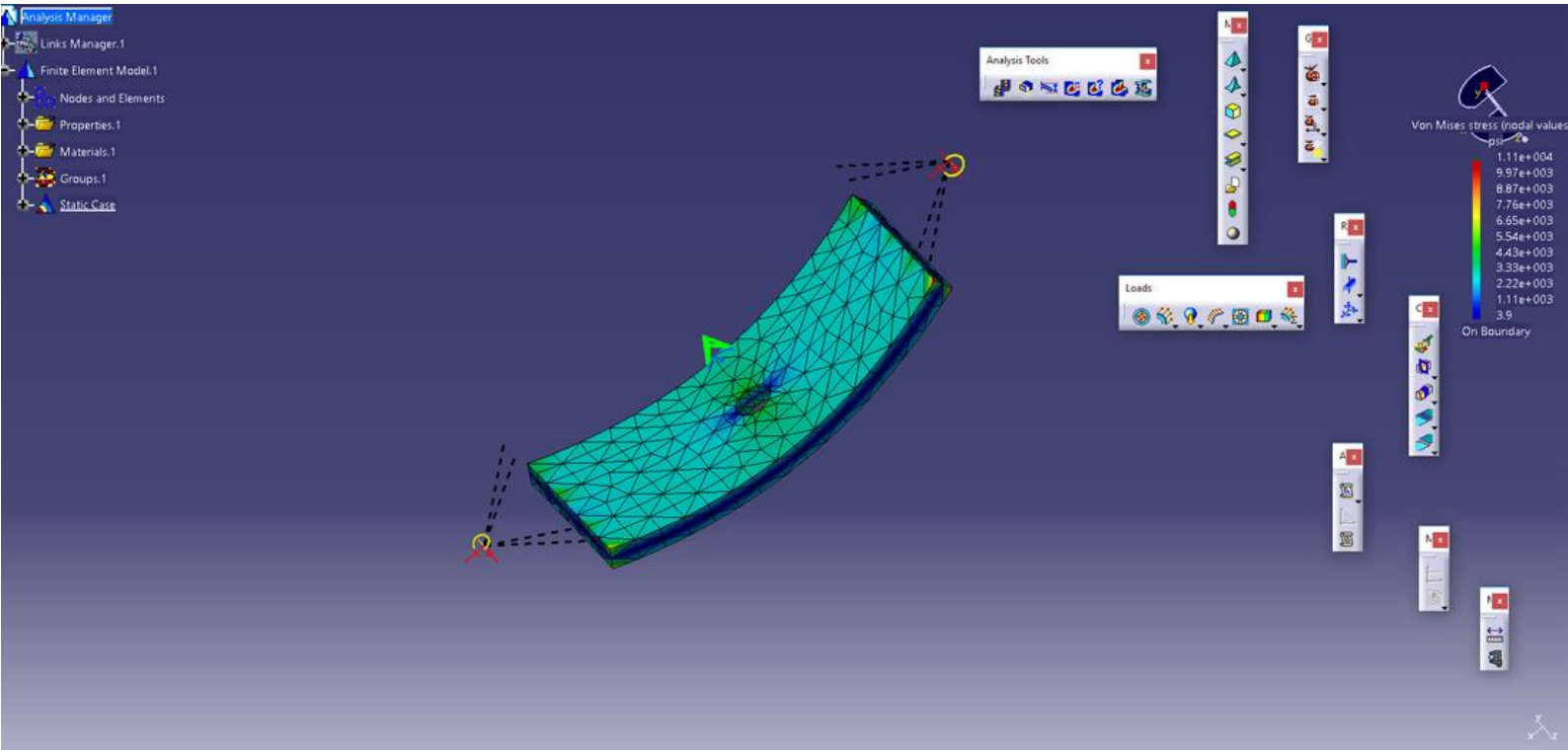

Part1
xy plane
yz plane
zx plane
PartBody
1
Circle.2
Point.7
X
Y
Z
Point.8
X
Y
Z
Point.9
X
Y
Z
Point.10
X
Y
Z
Point.11
Spline.1
Intersect.1
Multi Output.2 (Project)
Project.1

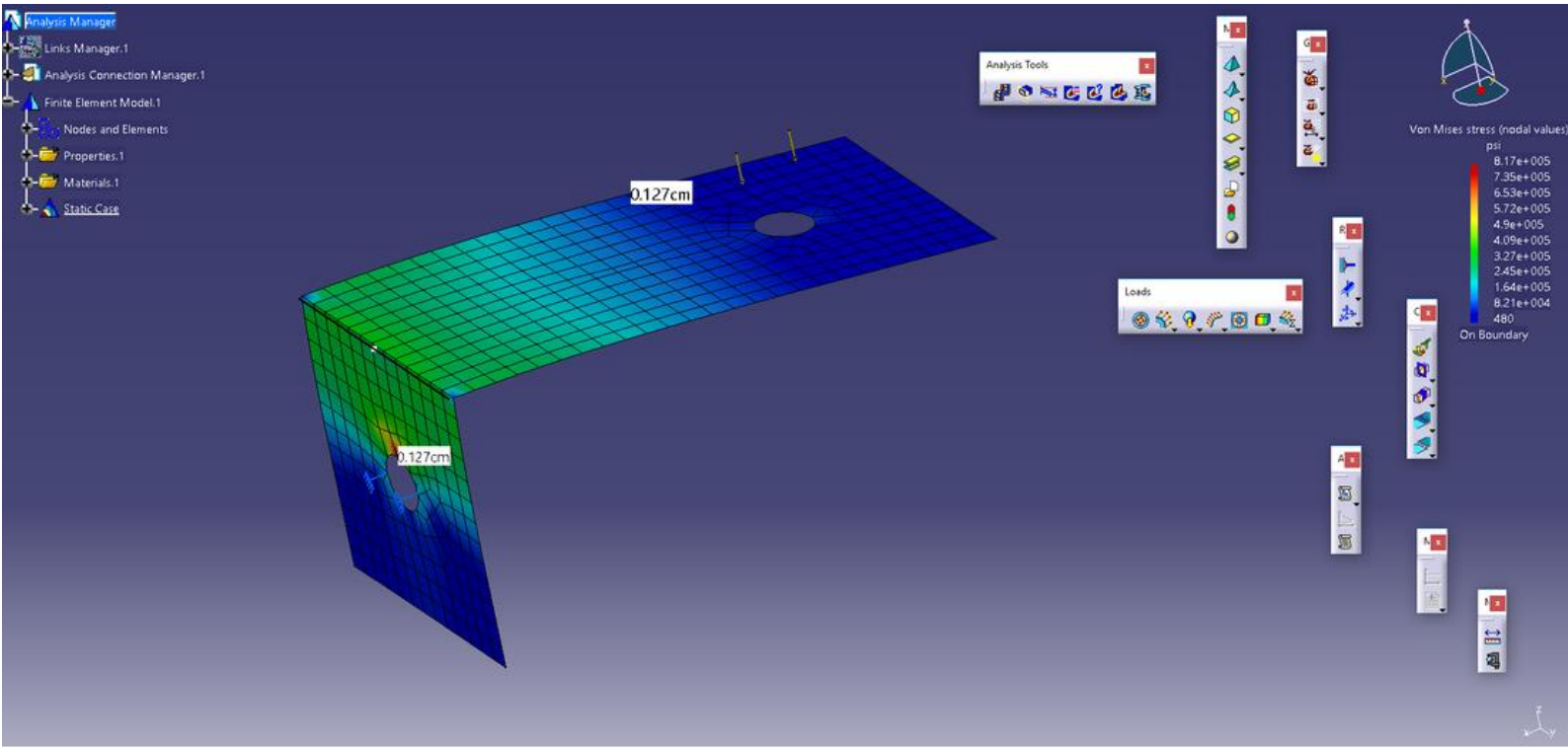

Teapot
xy plane
yz plane
zx plane
PartBody
Wireframe
Iron
Sketch.2
Plane.1
Sketch.3
Material
Body Surface
Line.1
Multi-sections Surface.1
Sketch.4
Revolute.1
Sketch.5
Plane.2
Sketch.6
Sweep.1
Trim.1
Join.1
Iron
PSU

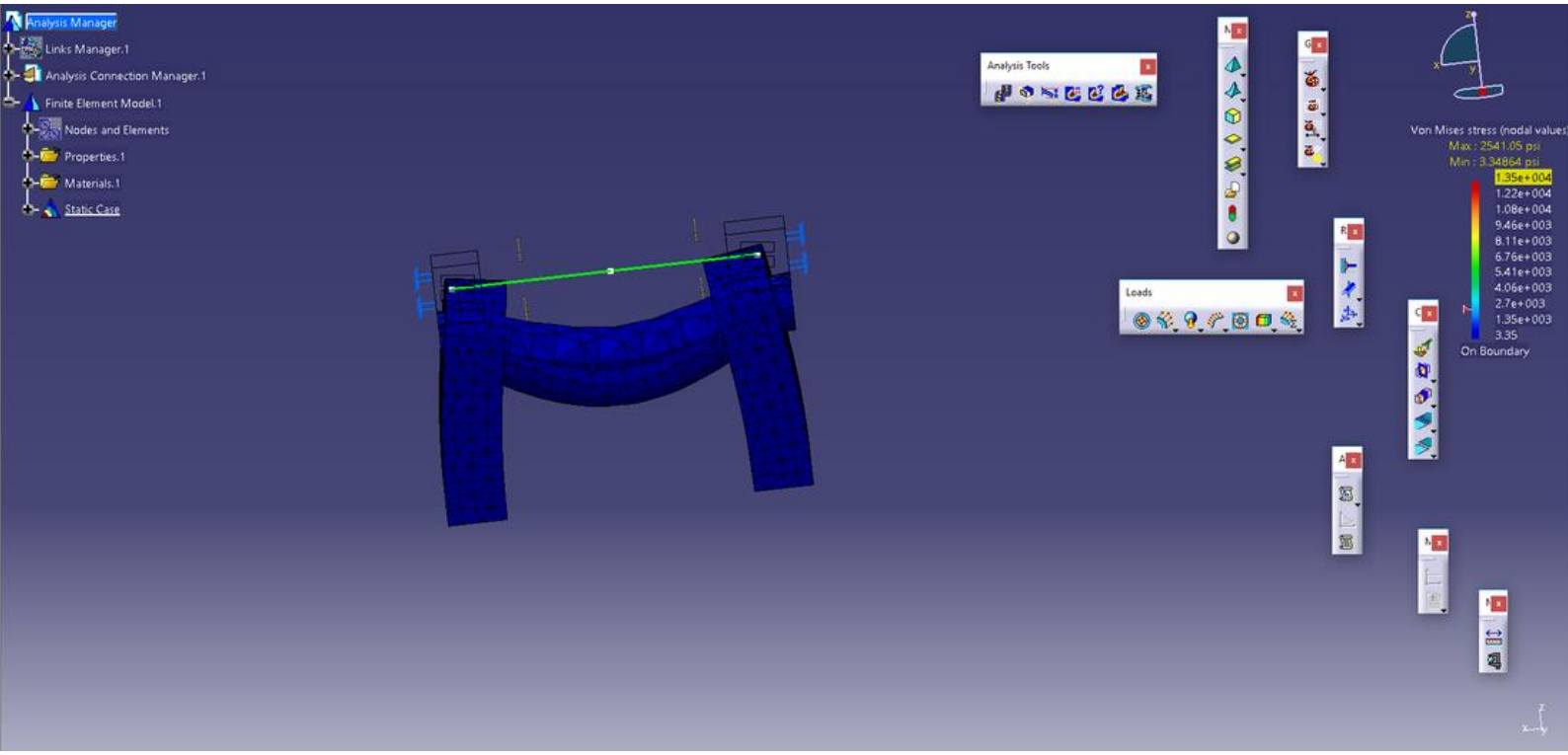

U-JOINT ASSEMBLY
Swivel (Swivel.1)
Part2 (Top U-joint)
Part2 (bottom ujoint)
Constraints
Applications

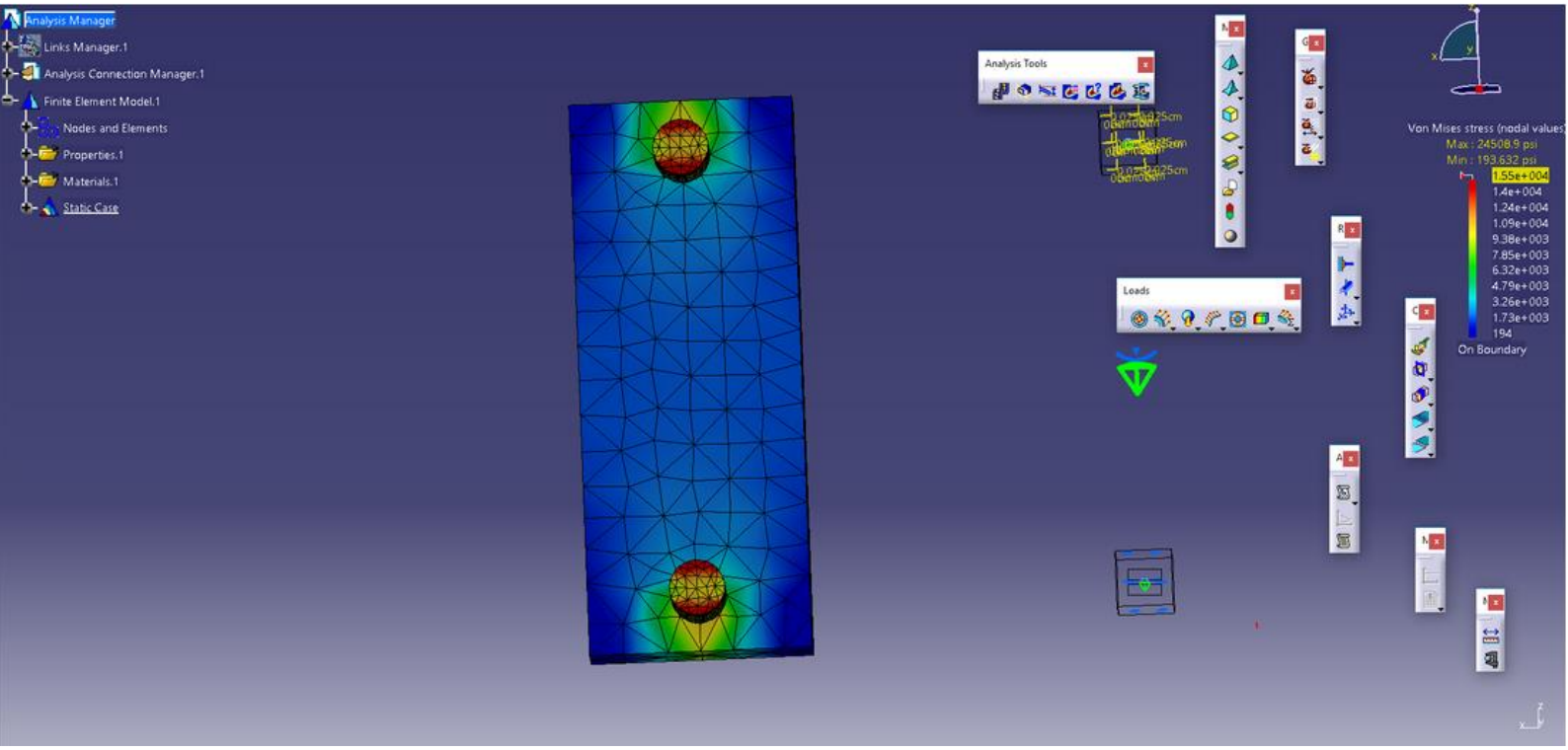

Analysis Manager
Links Manager.1
Finite Element Model.1
Nodes and Elements
Properties.1
Materials.1
Static Case
Analysis Tools
Loads
Von Mises stress (nodal values)
psi
625
577
529
480
432
384
335
287
239
191
142
On Boundary

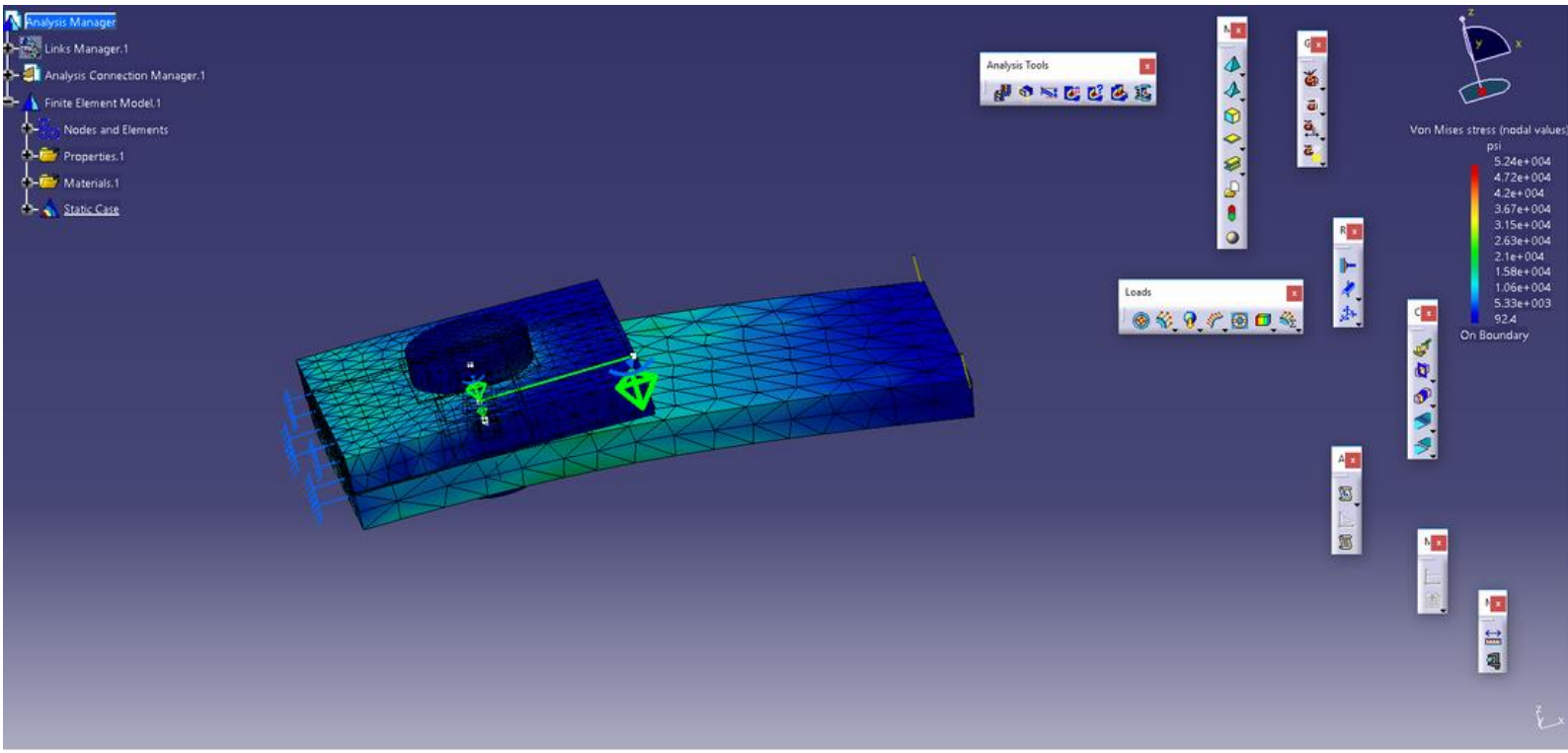

Analysis Manager
Links Manager.1
Finite Element Model.1
Nodes and Elements
Properties.1
Materials.1
Static Case
Analysis Tools
Loads
Von Mises stress (nodal values)
psi
3.9e+003
3.51e+003
3.13e+003
2.74e+003
2.36e+003
1.97e+003
1.58e+003
1.2e+003
813
427
40.9
On Boundary

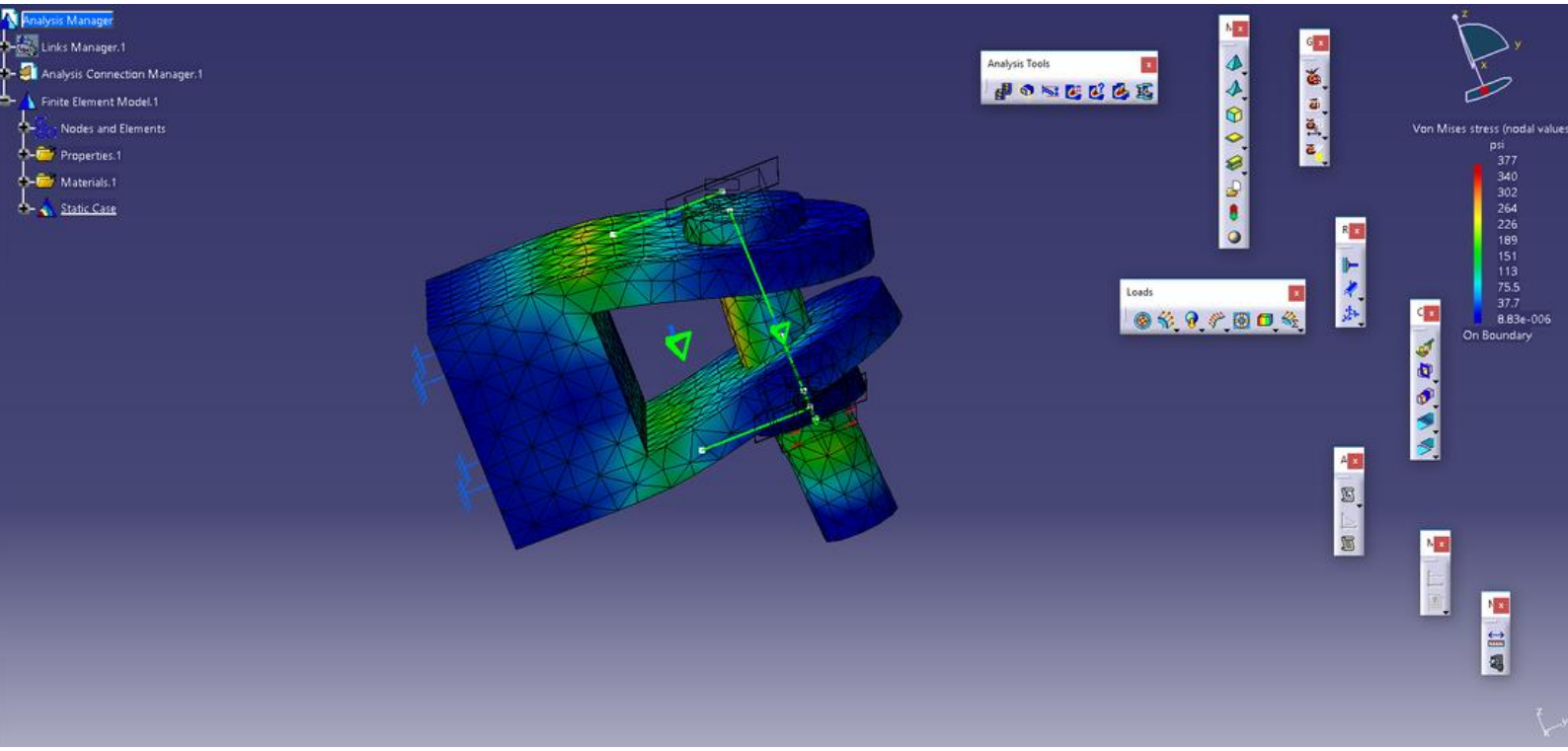

Analysis Manager
Links Manager.1
Finite Element Model.1
Nodes and Elements
Properties.1
Materials.1
Groups.1
Static Case
Analysis Tools
Loads
Von Mises stress (nodal values)
psi
1.11e+004
9.97e+003
8.87e+003
7.76e+003
6.65e+003
5.54e+003
4.43e+003
3.33e+003
2.22e+003
1.11e+003
3.9
On Boundary


Analysis Manager
Links Manager.1
Analysis Connection Manager.1
Finite Element Model.1
Nodes and Elements
Properties.1
Materials.1
Static Case
0.127cm
0.127cm
Analysis Tools
Loads
Von Mises stress (nodal values)
psi
8.17e+005
7.35e+005
6.53e+005
5.72e+005
4.9e+005
4.09e+005
3.27e+005
2.45e+005
1.64e+005
8.21e+004
480
On Boundary


Analysis Manager
Links Manager.1
Analysis Connection Manager.1
Finite Element Model.1
Nodes and Elements
Properties.1
Materials.1
Static Case
Analysis Tools
Loads
Von Mises stress (nodal values)
Max : 2541.05 psi
Min : 3.34864 psi
1.35e+004
1.22e+004
1.08e+004
9.46e+003
8.11e+003
6.76e+003
5.41e+003
4.06e+003
2.7e+003
1.35e+003
3.35
On Boundary


Analysis Manager
Links Manager.1
Analysis Connection Manager.1
Finite Element Model.1
Nodes and Elements
Properties.1
Materials.1
Static Case
Analysis Tools
Loads
Von Mises stress (nodal values)
Max : 24508.9 psi
Min : 193.632 psi
1.55e+004
1.4e+004
1.24e+004
1.09e+004
9.38e+003
7.85e+003
6.32e+003
4.79e+003
3.26e+003
1.73e+003
194
On Boundary

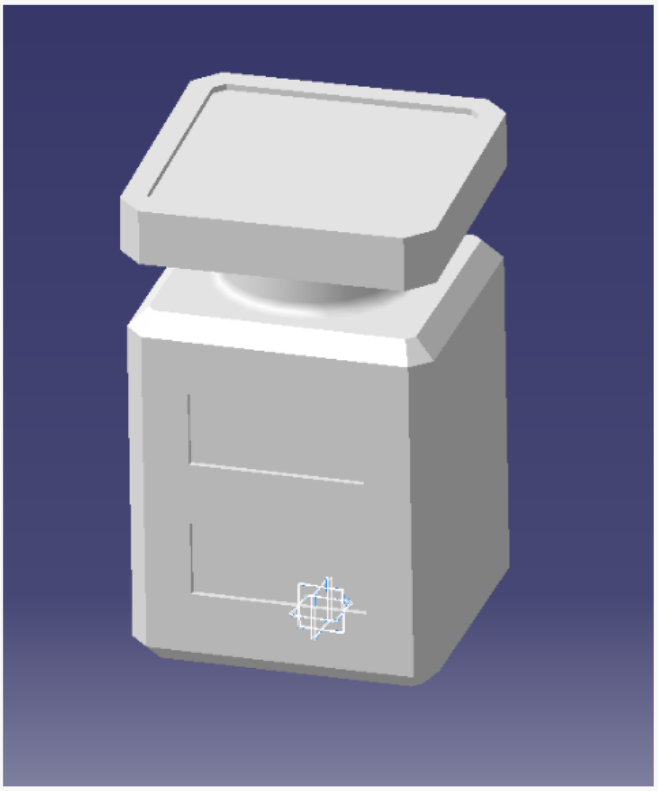

Analysis Manager
Links Manager.1
Analysis Connection Manager.1
Finite Element Model.1
Nodes and Elements
Properties.1
Materials.1
Static Case
Analysis Tools
Loads
Von Mises stress (nodal values)
psi
5.24e+004
4.72e+004
4.2e+004
3.67e+004
3.15e+004
2.63e+004
2.1e+004
1.58e+004
1.06e+004
5.33e+003
92.4
On Boundary

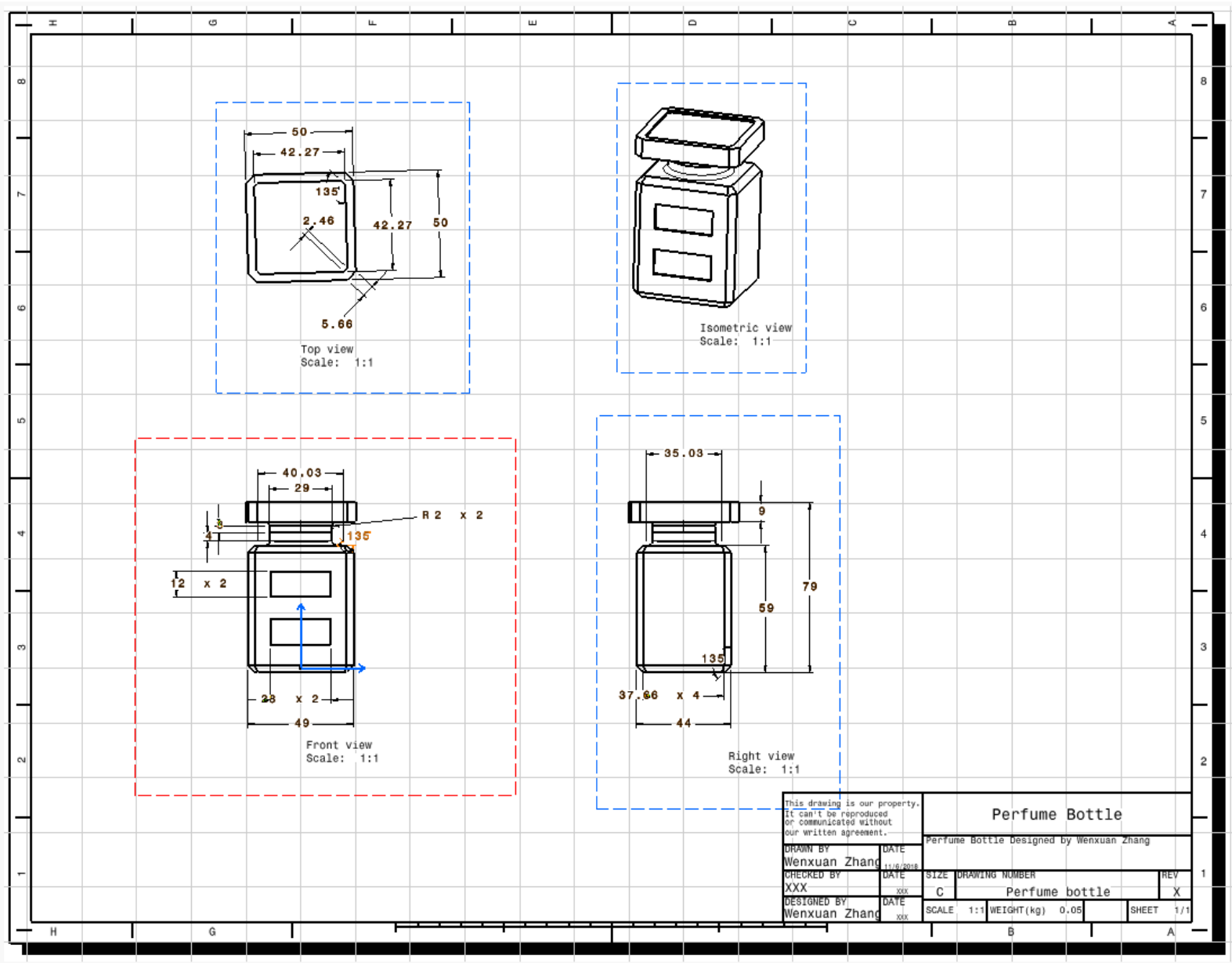

Analysis Manager
Links Manager.1
Analysis Connection Manager.1
Finite Element Model.1
Nodes and Elements
Properties.1
Materials.1
Static Case
Analysis Tools
Loads
Von Mises stress (nodal values)
psi
377
340
302
264
226
189
151
113
75.5
37.7
8.83e-006
On Boundary

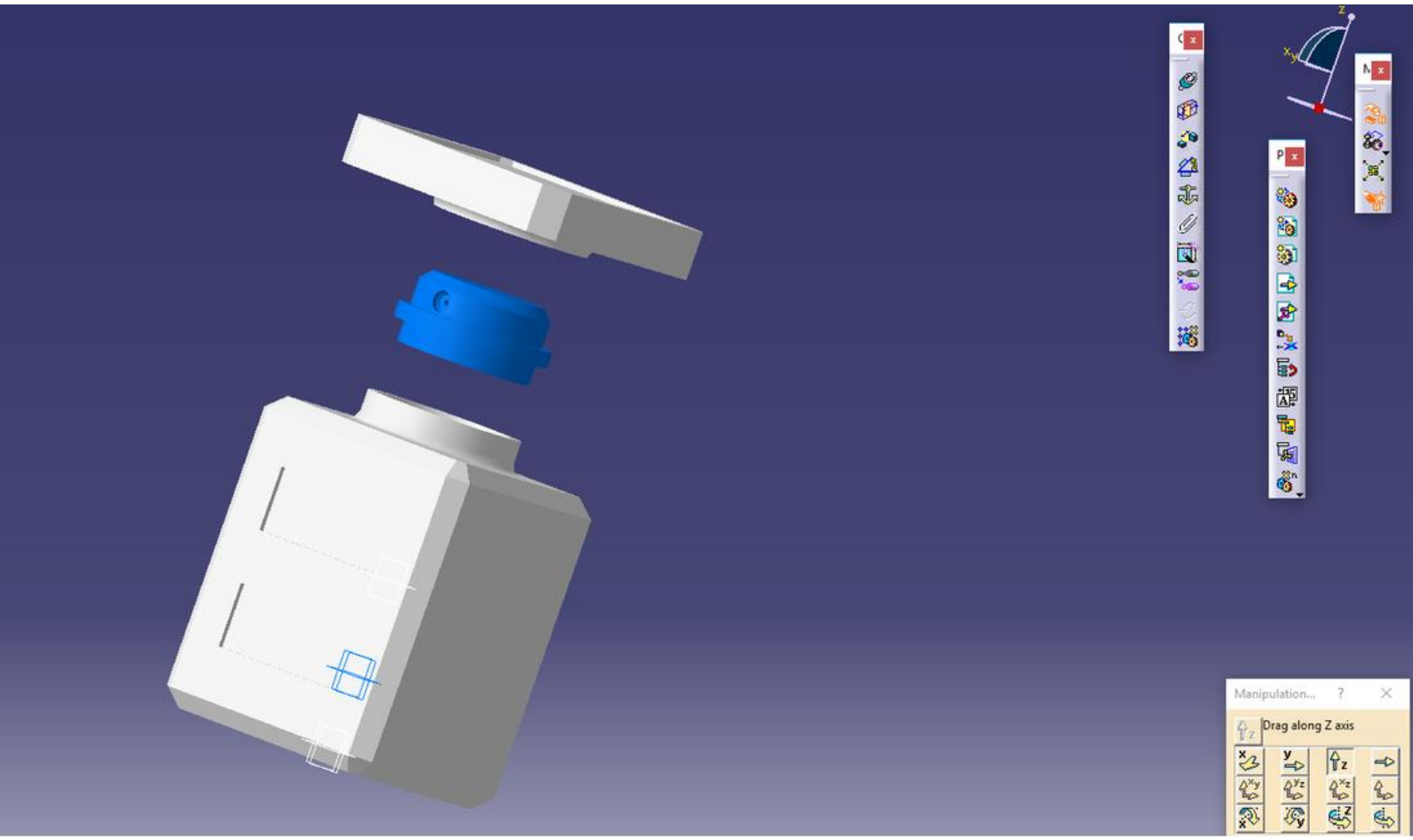
The Mini-Design Project

Design Task:
Design and produce a prototype via 3D printing of an innovative perfume bottle.

Design Specifications:
• The bottle is used for a volume of 100 mL (or ~ 3.4 FL OZ).
Note: 1.0 FL OZ = 29.5735 mL, and 1000 mm3 = 1.0 mL;
• The maximum size of the bottle should not be greater than 80 x 80 x 80 mm3;
• The minimum thickness of the perfume bottle should not be less than 2 mm to ensure a successful rapid prototyping.

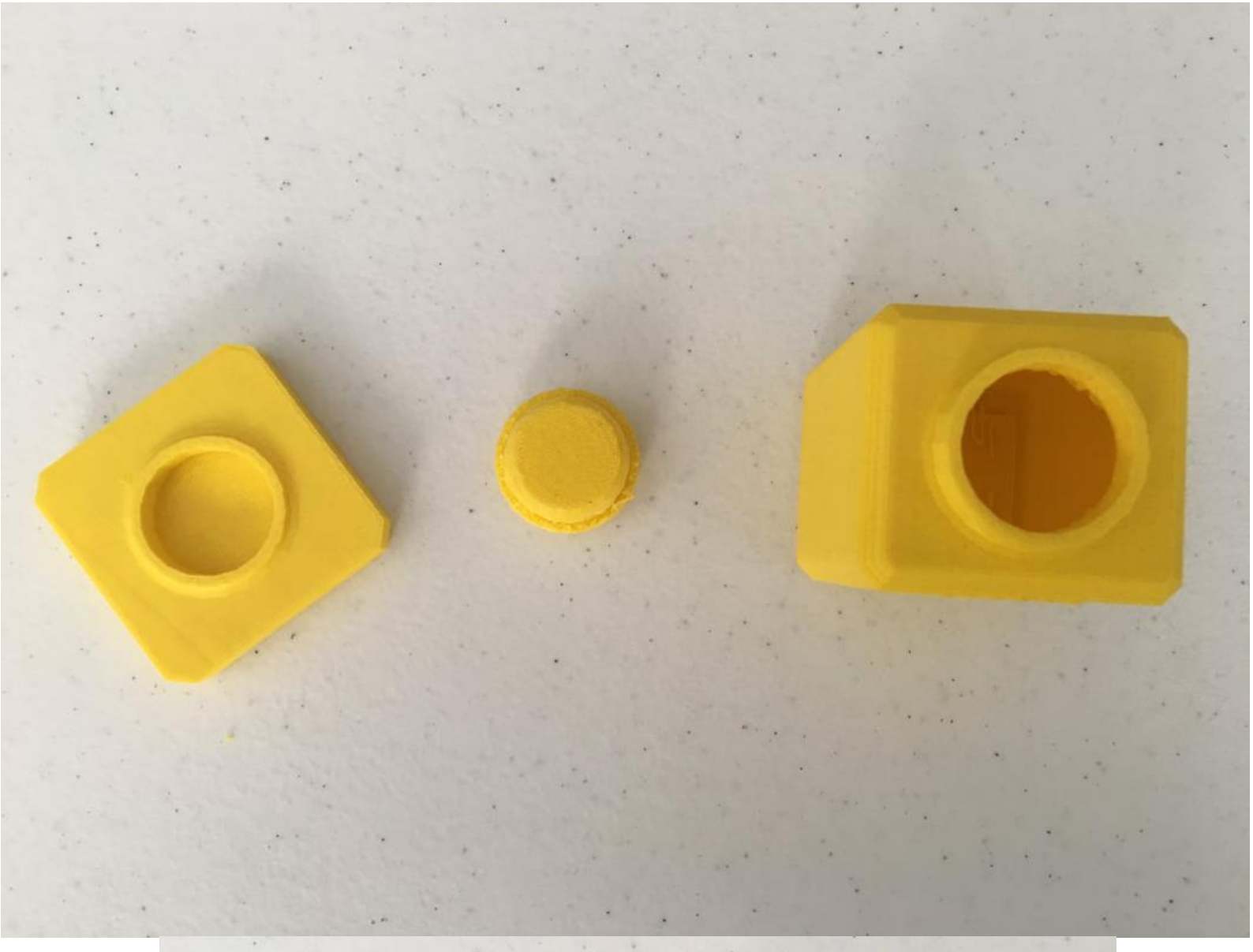






3-D Printing of Perfume Bottle

For this perfume bottle design, I 3-D printed it out. When I was trying to print the perfume bottle, I had some problems to save this product file as stl file. So I print out three parts of the perfume bottle Separately. It couldn't assemble together at the beginning because of the 3-D printer's tolerance. After I milled the parts, they could assemble.



The Final Design Project

Design Task:

Design a chair capable of holding a person of 300 lbs and then conduct a finite element analysis to verify/prove that the chair is safe under such a load.

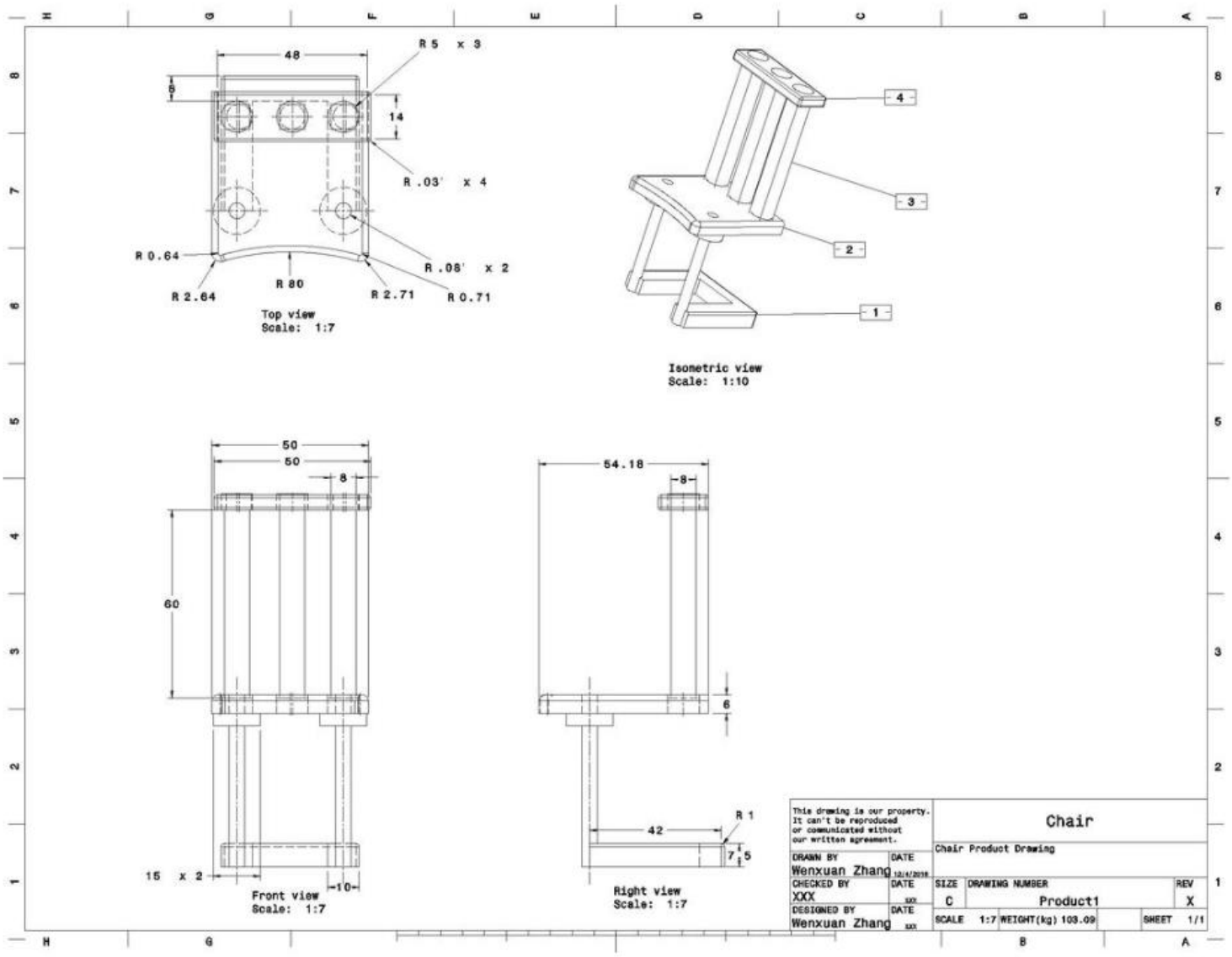
Design Specifications:

The chair must be able to withhold up to 300 lbs;
The chair should be ergonomically sound;
The chair should be durable;
The chair should be comfortable;
The chair should cost no more than $100;
The chair should be safe.

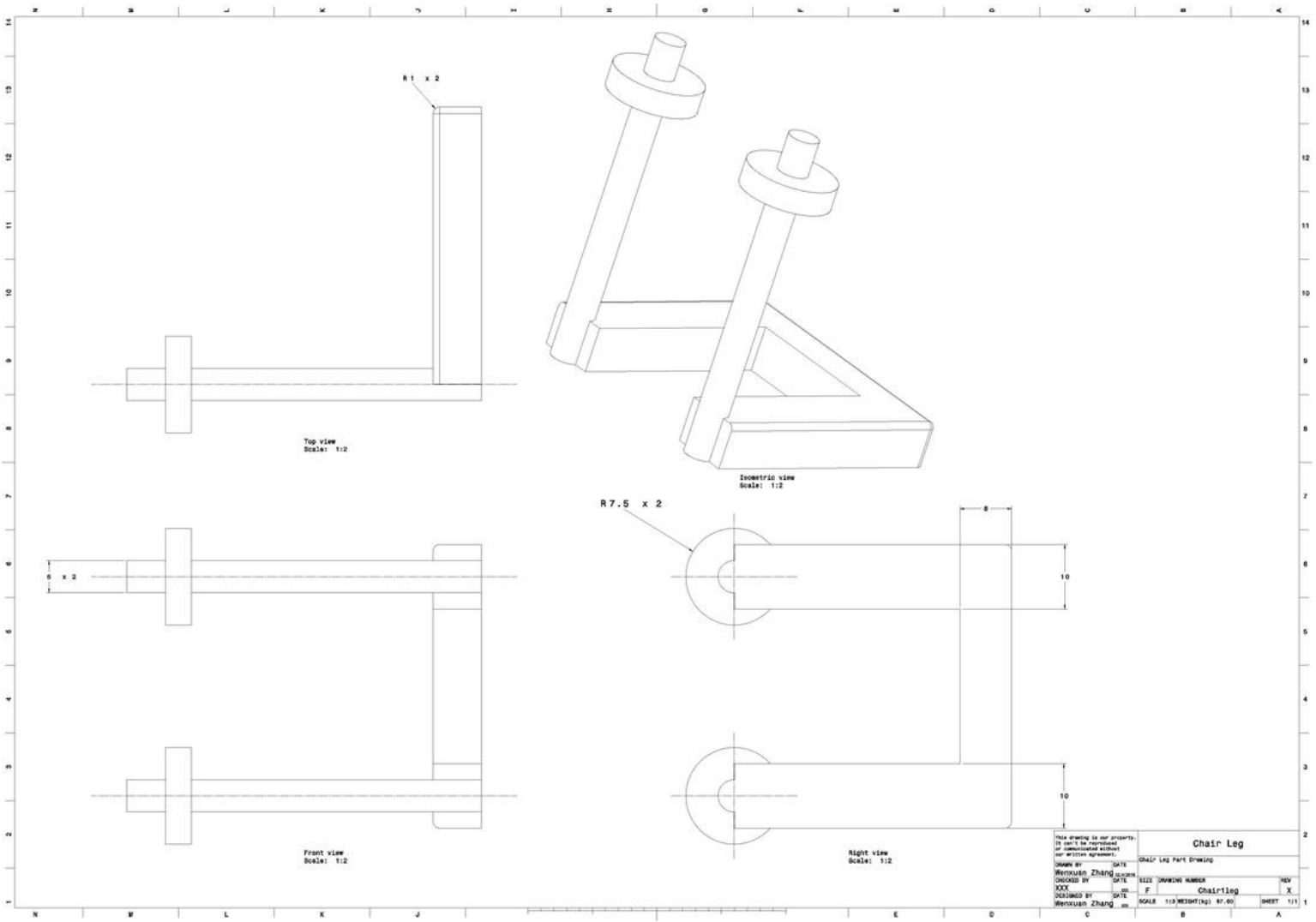
Major Deliverables:

A complete design report (part of the design portfolio for the course) including the following items:
A solid model generated by CATIA;
A complete set of working drawings including an assembly drawing and detail drawings for non-standard parts;
A complete FE analysis report.

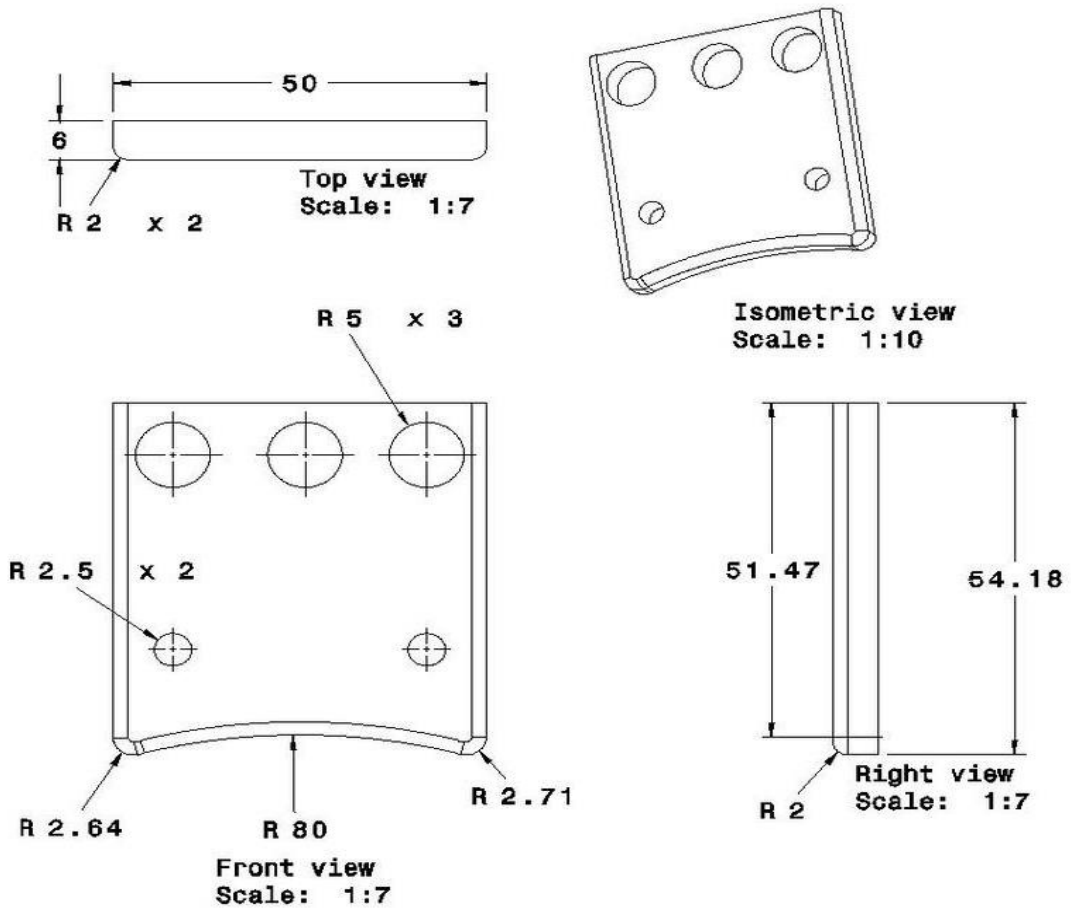
Chair Product Drawing



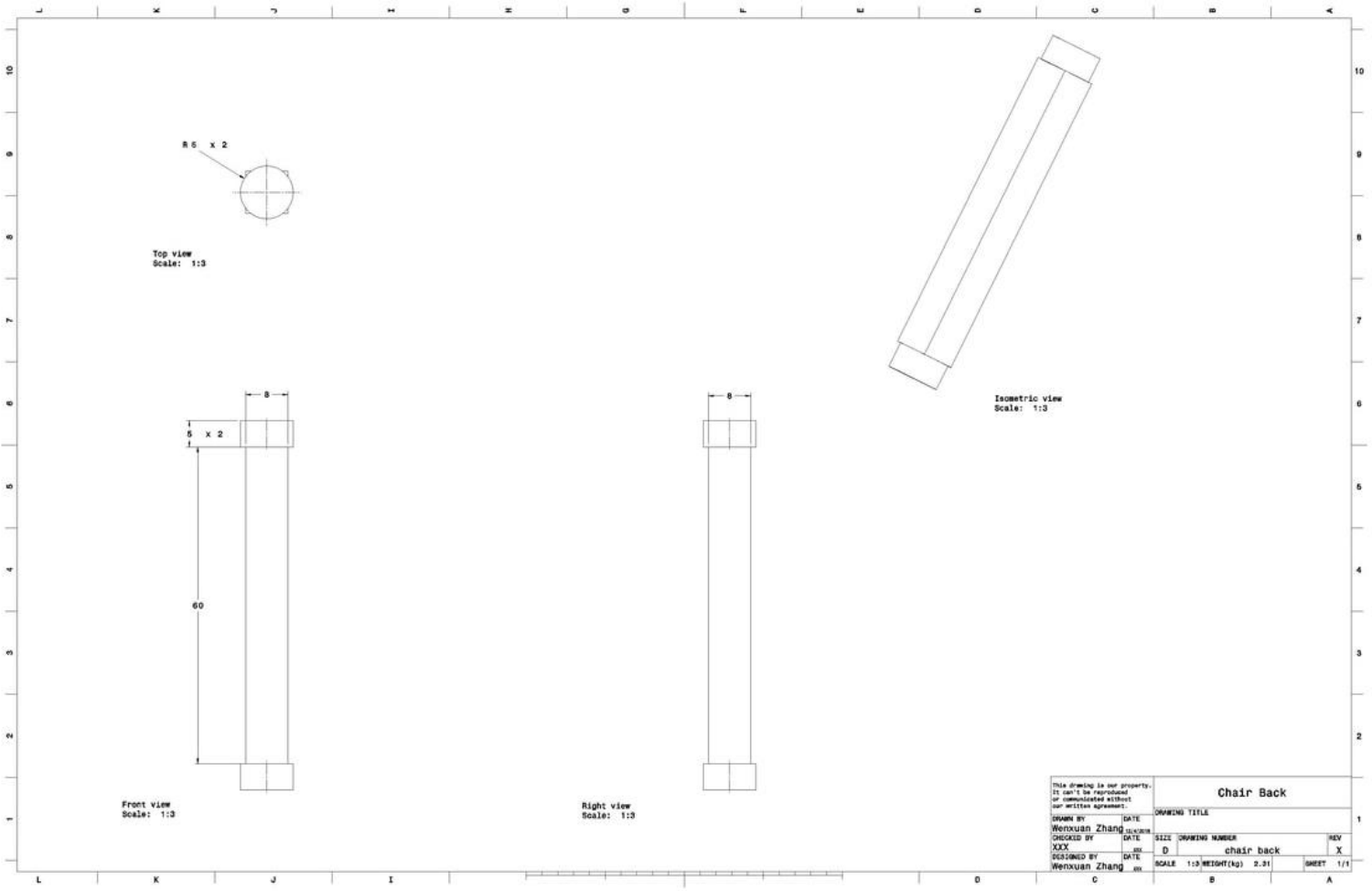
Part 1 Drawing



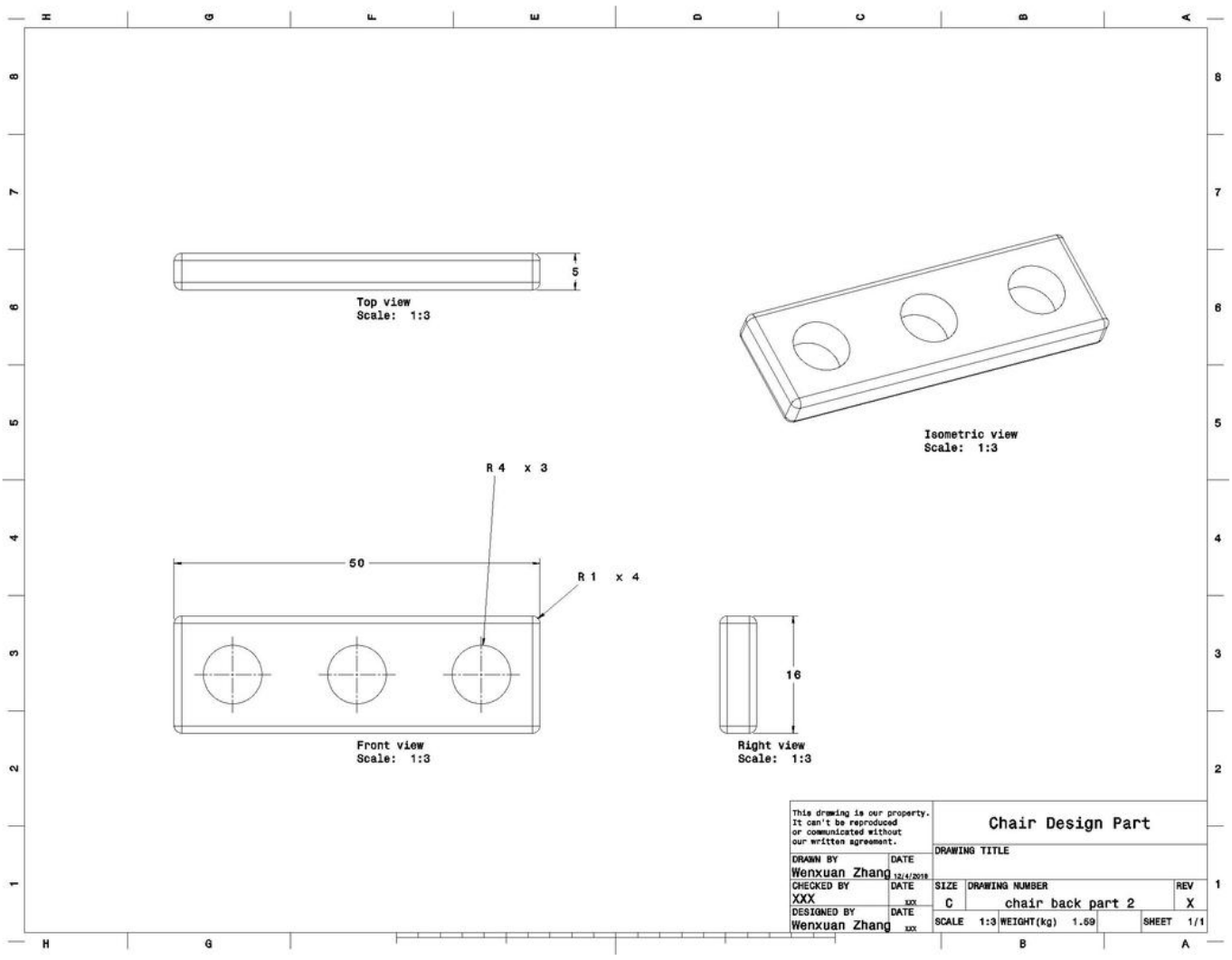
Part 2 Drawing



Part 3 Drawing



Part 4 Drawing



Analysis Report for Chair

MESH:

Entity	Size
Nodes	3990
Elements	12499

ELEMENT TYPE:

Connectivity	Statistics
SPIDER	173 (1.38%)
TE4	12320 (98.57%)
NSBAR	6 (0.05%)

ELEMENT QUALITY:

Criterion	Good	Poor	Bad	Worst	Average
Stretch	12203 (99.05%)	117 (0.95%)	0 (0.00%)	0.245	0.605
Aspect Ratio	10681 (86.70%)	1565 (12.70%)	74 (0.60%)	7.340	2.020

Materials.1

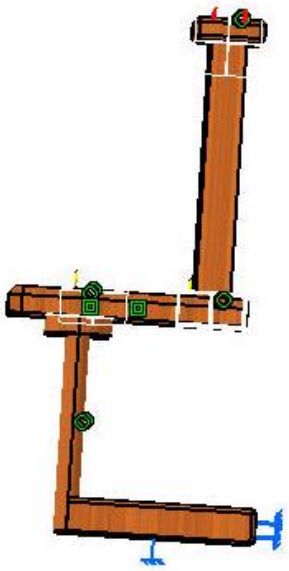
Materials.1

Material	Pine
Young's modulus	2.466e+006psi
Poisson's ratio	0.45
Density	500kg_m3
Coefficient of thermal expansion	3.75e-006_Kdeg
Yield strength	0psi

Material	Iron
Young's modulus	3.06e+007psi
Poisson's ratio	0.291
Density	7870kg_m3
Coefficient of thermal expansion	1.21e-005_Kdeg
Yield strength	44961.699psi

Static Case

Boundary Conditions



STRUCTURE Computation

Number of nodes	:	3990
Number of elements	:	12499
Number of D.O.F.	:	12006
Number of Contact relations	:	161
Number of coefficients	:	848
Number of Kinematic relations	:	1059
Number of coefficients	:	4164

Linear tetrahedron	:	12320
Translation rigid spider	:	12
Rigid spider	:	6
Contact join	:	161

LOAD Computation

Name: Loads.1

Applied load resultant :

Fx	=	7	.	273e-014	N
Fy	=	-9	.	686e-014	N
Fz	=	-1	.	334e+003	N
Mx	=	3	.	790e+002	Nxm
My	=	-1	.	088e+003	Nxm
Mz	=	9	.	810e-014	Nxm

STIFFNESS Computation

Number of lines	:	12006		
Number of coefficients	:	203814		
Number of blocks	:	1		
Maximum number of coefficients per bloc	:	203814		
Total matrix size	:	2	. 38	Mb

SINGULARITY Computation

Restraint: Restraints.1

Number of local singularities	:	0
Number of singularities in translation	:	0
Number of singularities in rotation	:	0
Generated constraint type	:	MPC

CONSTRAINT Computation

Restraint: Restraints.1

Number of constraints	:	2072
Number of coefficients	:	0
Number of factorized constraints	:	2014
Number of coefficients	:	2326
Number of deferred constraints	:	0

FACTORIZED Computation

Method	:	SPARSE		
Number of factorized degrees	:	9992		
Number of supernodes	:	2126		
Number of overhead indices	:	74975		
Number of coefficients	:	868621		
Maximum front width	:	664		
Maximum front size	:	220780		
Size of the factorized matrix (Mb)	:	6	.	62705
Number of blocks	:	1		
Number of Mflops for factorization	:	2	.	275e+002
Number of Mflops for solve	:	3	.	524e+000
Minimum relative pivot	:	2	.	556e-009

Minimum and maximum pivot

Value	Dof	Node	x (cm)	y (cm)	z (cm)
4.2625e+000	Ty	3922	-6.6324e+001	-3.9801e+001	-7.7352e+000
3.2870e+010	Tz	1275	-6.8590e+001	-1.2000e+001	2.1814e+001
3.0052e+008	Rz	1571	-9.8241e+001	-8.0831e+000	6.7259e+001
3.9012e+009	Rz	1568	-8.0881e+001	-8.1208e+000	6.7267e+001

Minimum pivot

Value	Dof	Node	x (cm)	y (cm)	z (cm)
1.1796e+001	Tx	3922	-6.6324e+001	-3.9801e+001	-7.7352e+000
5.5880e+002	Ty	3921	-6.6166e+001	-3.6060e+001	2.2712e+000
6.4373e+005	Tx	3047	-6.9451e+001	-3.7522e+001	0.0000e+000
1.9795e+006	Tx	2823	-6.0590e+001	-3.0094e+001	-4.1500e+001
2.3511e+006	Tz	2638	-1.0151e+002	-5.1157e+001	3.9819e+000
3.3769e+006	Ty	3989	-6.6030e+001	-3.5957e+001	-3.1731e+001
3.4382e+006	Ty	3990	-6.5222e+001	-3.8221e+001	-4.5632e+001
3.4500e+006	Ty	3444	-6.4084e+001	-3.5552e+001	-1.8006e+001
3.5586e+006	Tz	3990	-6.5222e+001	-3.8221e+001	-4.5632e+001

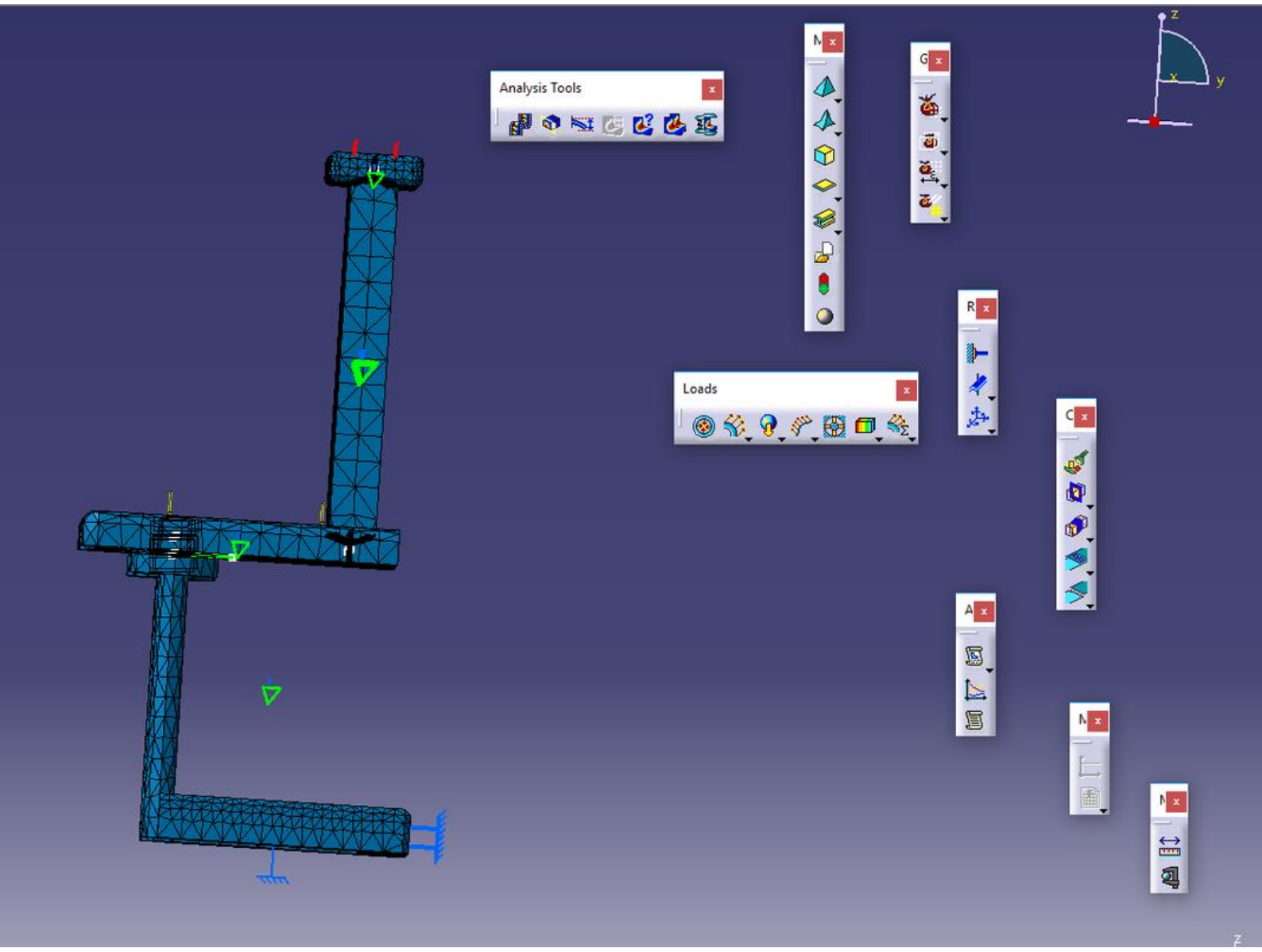
Value	Dof	Node	x (cm)	y (cm)	z (cm)
3.4286e+008	Rz	2644	-6.4522e+001	-7.5508e+000	2.9500e+000
3.5495e+008	Rx	2644	-6.4522e+001	-7.5508e+000	2.9500e+000
3.8797e+008	Rz	2648	-9.8463e+001	-7.5724e+000	2.9911e+000
4.1199e+008	Rx	2645	-8.0878e+001	-7.6602e+000	3.0244e+000
4.6086e+008	Rz	2645	-8.0878e+001	-7.6602e+000	3.0244e+000
4.8833e+008	Rz	1567	-6.4134e+001	-8.0847e+000	6.7250e+001
6.4027e+008	Ry	2644	-6.4522e+001	-7.5508e+000	2.9500e+000
8.1122e+008	Ry	2648	-9.8463e+001	-7.5724e+000	2.9911e+000
8.4902e+008	Rx	2648	-9.8463e+001	-7.5724e+000	2.9911e+000

Translational pivot distribution

Value	Percentage
10.E0 --> 10.E1	1.0020e-002
10.E1 --> 10.E2	1.0020e-002
10.E2 --> 10.E3	1.0020e-002
10.E3 --> 10.E4	0.0000e+000
10.E4 --> 10.E5	0.0000e+000
10.E5 --> 10.E6	1.0020e-002
10.E6 --> 10.E7	1.5030e-001
10.E7 --> 10.E8	2.3046e-001
10.E8 --> 10.E9	3.1824e+001
10.E9 --> 10.E10	5.5922e+001
10.E10 --> 10.E11	1.1834e+001

Rotational pivot distribution

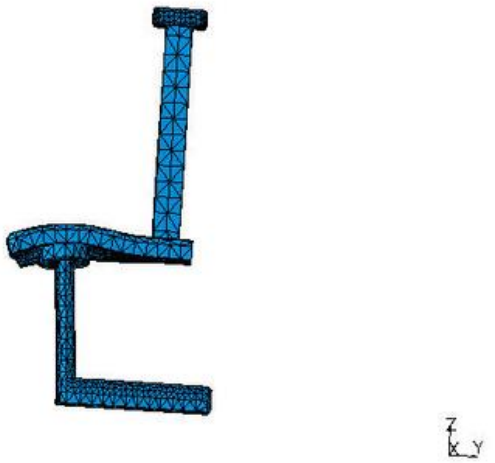
Value	Percentage
10.E8 --> 10.E9	9.1667e+001
10.E9 --> 10.E10	8.3333e+000



Equilibrium

Components	Applied Forces	Reactions	Residual	Relative Magnitude Error
Fx (N)	7.2734e-014	-9.9002e-012	-9.8275e-012	2.8801e-014
Fy (N)	-9.6863e-014	2.0544e-011	2.0447e-011	5.9925e-014
Fz (N)	-1.3345e+003	1.3345e+003	-6.3803e-008	1.8699e-010
Mx (Nxm)	3.7898e+002	-3.7898e+002	5.5869e-009	1.5361e-011
My (Nxm)	-1.0878e+003	1.0878e+003	-5.5750e-008	1.5329e-010
Mz (Nxm)	9.8101e-014	-1.6761e-011	-1.6663e-011	4.5815e-014

Static Case Solution.1 - Deformed mesh.2



Global Sensors

Sensor Name	Sensor Value
Energy	5.211e-004J
Global Error Rate (%)	30.855491638