

# Study Report



Analyzed File	Axis 6 (output) v3
Version	Autodesk Fusion 360 (2.0.8609)
Creation Date	2020-07-01, 15:31:46
Author	Grędys Przemysław

## Project Properties

Title	Studies
Author	jjjku

## Simulation Model 1:1

### Study 1 - Static Stress

#### Study Properties

Study Type	Static Stress
Last Modification Date	2020-07-01, 14:15:32

#### Settings

##### General

Contact Tolerance	0.1 mm
Remove Rigid Body Modes	No

##### Damping

##### Mesh

Average Element Size (% of model size)	
Solids	2
Scale Mesh Size Per Part	Yes
Average Element Size (absolute value)	-
Element Order	Parabolic
Create Curved Mesh Elements	No
Max. Turn Angle on Curves (Deg.)	60
Max. Adjacent Mesh Size Ratio	1.5
Max. Aspect Ratio	10
Minimum Element Size (% of average size)	20

**Adaptive Mesh Refinement**

Number of Refinement Steps	10
Results Convergence Tolerance (%)	5
Portion of Elements to Refine (%)	40
Results for Baseline Accuracy	Von Mises Stress

**Materials**

Component	Material	Safety Factor
LEGO_6587 v2:1	ABS Plastic	Yield Strength
LEGO_6538c v2:1	ABS Plastic	Yield Strength
LEGO_6538c v2:2	ABS Plastic	Yield Strength
LEGO_3705 v2:1	ABS Plastic	Yield Strength
LEGO_44294 v2:1	ABS Plastic	Yield Strength
LEGO_(axle triple pin) v2:1	ABS Plastic	Yield Strength
LEGO_(axle triple pin) v2:2	ABS Plastic	Yield Strength
LEGO_4019(gear 16) v2:1	ABS Plastic	Yield Strength
LEGO_4019(gear 16) v2:2	ABS Plastic	Yield Strength

**ABS Plastic**

Density	1.06E-06 kg / mm^3
Young's Modulus	2240 MPa
Poisson's Ratio	0.38
Yield Strength	20 MPa
Ultimate Tensile Strength	29.6 MPa
Thermal Conductivity	1.6E-04 W / (mm C)
Thermal Expansion Coefficient	8.57E-05 / C
Specific Heat	1500 J / (kg C)

**Contacts**

**Bonded**

Name
[S] Bonded1 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded2 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded3 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded4 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded5 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded6 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded7 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded8 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded9 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded10 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded11 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded12 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded13 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded14 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded15 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded16 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded17 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded18 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded19 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded20 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded21 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded22 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded23 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded24 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded25 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded26 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded27 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded28 [LEGO_44294 v2:1  LEGO_4019(gear 16) v2:2]
[S] Bonded29 [LEGO_3705 v2:1  LEGO_4019(gear 16) v2:1]
[S] Bonded30 [LEGO_3705 v2:1  LEGO_4019(gear 16) v2:1]
[S] Bonded31 [LEGO_3705 v2:1  LEGO_4019(gear 16) v2:1]
[S] Bonded32 [LEGO_3705 v2:1  LEGO_4019(gear 16) v2:1]
[S] Bonded33 [LEGO_3705 v2:1  LEGO_4019(gear 16) v2:1]





[S] Bonded188 [LEGO_6538c v2:1  LEGO_3705 v2:1]
[S] Bonded189 [LEGO_6538c v2:1  LEGO_3705 v2:1]
[S] Bonded190 [LEGO_6538c v2:1  LEGO_3705 v2:1]
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[S] Bonded197 [LEGO_6538c v2:1  LEGO_4019(gear 16) v2:1]
[S] Bonded198 [LEGO_6538c v2:1  LEGO_4019(gear 16) v2:1]
[S] Bonded199 [LEGO_6538c v2:1  LEGO_3705 v2:1]
[S] Bonded200 [LEGO_6538c v2:1  LEGO_3705 v2:1]
[S] Bonded201 [LEGO_6538c v2:1  LEGO_3705 v2:1]
[S] Bonded202 [LEGO_6538c v2:1  LEGO_3705 v2:1]
[S] Bonded203 [LEGO_6538c v2:1  LEGO_3705 v2:1]
[S] Bonded204 [LEGO_6538c v2:1  LEGO_3705 v2:1]
[S] Bonded205 [LEGO_6538c v2:1  LEGO_4019(gear 16) v2:1]
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[S] Bonded207 [LEGO_6538c v2:1  LEGO_4019(gear 16) v2:1]
[S] Bonded208 [LEGO_6538c v2:1  LEGO_4019(gear 16) v2:1]
[S] Bonded209 [LEGO_6538c v2:1  LEGO_4019(gear 16) v2:1]
[S] Bonded210 [LEGO_6538c v2:1  LEGO_4019(gear 16) v2:1]
[S] Bonded211 [LEGO_6538c v2:1  LEGO_3705 v2:1]
[S] Bonded212 [LEGO_6538c v2:1  LEGO_3705 v2:1]
[S] Bonded213 [LEGO_6587 v2:1  LEGO_(axle triple pin) v2:1]
[S] Bonded214 [LEGO_6587 v2:1  LEGO_6538c v2:1]
[S] Bonded215 [LEGO_6587 v2:1  LEGO_6538c v2:1]
[S] Bonded216 [LEGO_6587 v2:1  LEGO_6538c v2:1]
[S] Bonded217 [LEGO_6587 v2:1  LEGO_6538c v2:1]
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[S] Bonded219 [LEGO_6587 v2:1  LEGO_6538c v2:1]
[S] Bonded220 [LEGO_6587 v2:1  LEGO_6538c v2:1]
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[S] Bonded233 [LEGO_6587 v2:1  LEGO_6538c v2:1]
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[S] Bonded245 [LEGO_6587 v2:1  LEGO_6538c v2:1]
[S] Bonded246 [LEGO_6587 v2:1  LEGO_(axle triple pin) v2:1]
[S] Bonded247 [LEGO_6587 v2:1  LEGO_(axle triple pin) v2:1]
[S] Bonded248 [LEGO_6587 v2:1  LEGO_(axle triple pin) v2:1]
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[S] Bonded250 [LEGO_6587 v2:1  LEGO_(axle triple pin) v2:1]
[S] Bonded251 [LEGO_6587 v2:1  LEGO_(axle triple pin) v2:1]
[S] Bonded252 [LEGO_6587 v2:1  LEGO_(axle triple pin) v2:1]
[S] Bonded253 [LEGO_6587 v2:1  LEGO_(axle triple pin) v2:1]

Mesh

Type	Nodes	Elements
Solids	2760305	1853306

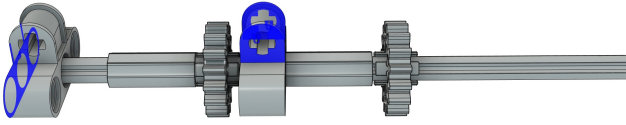
Load Case1

Constraints

Fixed2

Type	Fixed
Ux	Yes
Uy	Yes
Uz	Yes

☐ Selected Entities

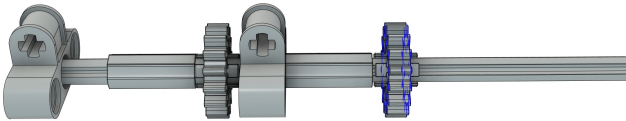


☐ Loads

☐ Moment1

Type	Moment
Magnitude	350 N mm
X Value	-350 N mm
Y Value	-3.628E-14 N mm
Z Value	-5.909E-15 N mm

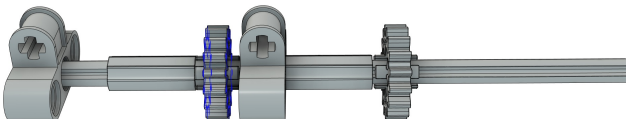
☐ Selected Entities



☐ Moment2

Type	Moment
Magnitude	-350 N mm
X Value	-350 N mm
Y Value	-3.77E-14 N mm
Z Value	2.565E-14 N mm

☐ Selected Entities



☐ Results


☐ Result Summary

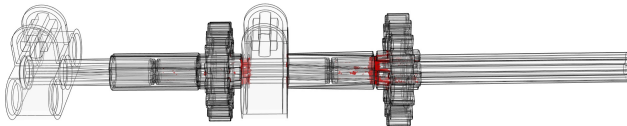
Name	Minimum	Maximum
Safety Factor		
Safety Factor (Per Body)	0.1058	15
Stress		
Von Mises	2.324E-07 MPa	189.1 MPa
1st Principal	-139.5 MPa	198.1 MPa

3rd Principal	-222.9 MPa	64.67 MPa
Normal XX	-172.2 MPa	131.2 MPa
Normal YY	-171.5 MPa	117.1 MPa
Normal ZZ	-211.6 MPa	140.5 MPa
Shear XY	-73.99 MPa	91.94 MPa
Shear YZ	-66.19 MPa	60.07 MPa
Shear ZX	-65.22 MPa	80.61 MPa
Displacement		
Total	0 mm	0.6382 mm
X	-0.01044 mm	0.01155 mm
Y	-0.6293 mm	0.6102 mm
Z	-0.6159 mm	0.6239 mm
Reaction Force		
Total	0 N	1.364 N
X	-0.2434 N	0.2983 N
Y	-0.369 N	0.1233 N
Z	-1.204 N	1.344 N
Strain		
Equivalent	1.703E-10	0.1509
1st Principal	-5.18E-04	0.138
3rd Principal	-0.1419	3.871E-04
Normal XX	-0.04084	0.03577
Normal YY	-0.04737	0.03869
Normal ZZ	-0.04961	0.05088
Shear XY	-0.09117	0.1133
Shear YZ	-0.08156	0.07402
Shear ZX	-0.08036	0.09933
Contact Pressure		
Total	0 MPa	175.3 MPa
X	-129.7 MPa	57.25 MPa
Y	-121.3 MPa	99.9 MPa
Z	-135.2 MPa	123.1 MPa

## ☐ Safety Factor

### ☐ Safety Factor (Per Body)

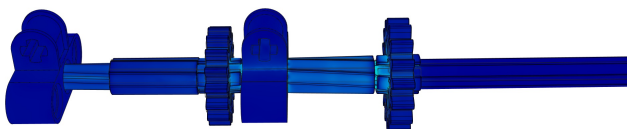
0  8, Threshold: 0 - 0.933



## ☐ Stress

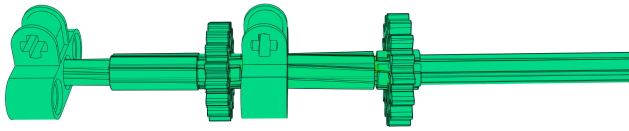
### ☐ Von Mises

[MPa] 0  189.1



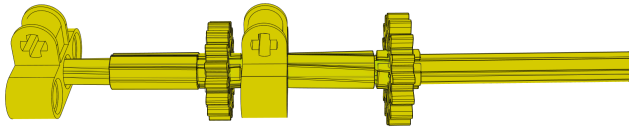
### ☐ 1st Principal

[MPa] -139.5  198.1



☐ **3rd Principal**

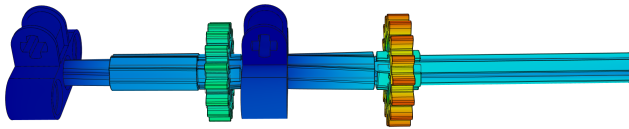
[MPa] -222.9  64.7



☐ **Displacement**

☐ **Total**

[mm] 0  0.6382



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Image Width (pixels):