

Study Report



Analyzed File	Axis 2 v8
Version	Autodesk Fusion 360 (2.0.8609)
Creation Date	2020-07-02, 07:25:47
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	2020-07-02, 00:42:40

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	6
Results Convergence Tolerance (%)	5
Portion of Elements to Refine (%)	40
Results for Baseline Accuracy	Von Mises Stress

Materials

Component	Material	Safety Factor
LEGO_(axle connector) v2:1	PC/ABS Plastic	Yield Strength
LEGO_3706 v2:1	PC/ABS Plastic	Yield Strength
LEGO_4519 v2:1	PC/ABS Plastic	Yield Strength
LEGO_(axle triple pin) v2:1	PC/ABS Plastic	Yield Strength
LEGO_(axle triple pin) v2:2	PC/ABS Plastic	Yield Strength
LEGO_(axle triple pin) v2:3	PC/ABS Plastic	Yield Strength
LEGO_3648(gear 24) v2:1	PC/ABS Plastic	Yield Strength

PC/ABS Plastic

Density	1.1E-06 kg / mm^3
Young's Modulus	2780 MPa
Poisson's Ratio	0.4
Yield Strength	54.4 MPa
Ultimate Tensile Strength	54.4 MPa
Thermal Conductivity	2.4E-04 W / (mm C)
Thermal Expansion Coefficient	6.7E-05 / C
Specific Heat	2133 J / (kg C)

Contacts

Bonded

Name
[S] Bonded1 [LEGO_(axle triple pin) v2:2 LEGO_3648(gear 24) v2:1]
[S] Bonded2 [LEGO_(axle triple pin) v2:2 LEGO_3648(gear 24) v2:1]
[S] Bonded3 [LEGO_4519 v2:1 LEGO_(axle triple pin) v2:1]
[S] Bonded4 [LEGO_3706 v2:1 LEGO_(axle triple pin) v2:2]
[S] Bonded5 [LEGO_3706 v2:1 LEGO_(axle triple pin) v2:2]
[S] Bonded6 [LEGO_3706 v2:1 LEGO_(axle triple pin) v2:2]
[S] Bonded7 [LEGO_3706 v2:1 LEGO_(axle triple pin) v2:2]
[S] Bonded8 [LEGO_3706 v2:1 LEGO_3648(gear 24) v2:1]
[S] Bonded9 [LEGO_3706 v2:1 LEGO_(axle triple pin) v2:3]
[S] Bonded10 [LEGO_3706 v2:1 LEGO_(axle triple pin) v2:2]
[S] Bonded11 [LEGO_3706 v2:1 LEGO_3648(gear 24) v2:1]
[S] Bonded12 [LEGO_3706 v2:1 LEGO_(axle triple pin) v2:3]
[S] Bonded13 [LEGO_3706 v2:1 LEGO_(axle triple pin) v2:2]
[S] Bonded14 [LEGO_3706 v2:1 LEGO_3648(gear 24) v2:1]
[S] Bonded15 [LEGO_3706 v2:1 LEGO_(axle triple pin) v2:3]
[S] Bonded16 [LEGO_3706 v2:1 LEGO_(axle triple pin) v2:2]
[S] Bonded17 [LEGO_3706 v2:1 LEGO_3648(gear 24) v2:1]
[S] Bonded18 [LEGO_3706 v2:1 LEGO_(axle triple pin) v2:3]
[S] Bonded19 [LEGO_3706 v2:1 LEGO_(axle triple pin) v2:2]
[S] Bonded20 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]
[S] Bonded21 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]
[S] Bonded22 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]
[S] Bonded23 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]
[S] Bonded24 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]
[S] Bonded25 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]
[S] Bonded26 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]
[S] Bonded27 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]
[S] Bonded28 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]
[S] Bonded29 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]
[S] Bonded30 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]
[S] Bonded31 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]
[S] Bonded32 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]
[S] Bonded33 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]
[S] Bonded34 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]
[S] Bonded35 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]

[S] Bonded36 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]
[S] Bonded37 [LEGO_(axle connector) v2:1 LEGO_3706 v2:1]
[S] Bonded38 [LEGO_(axle connector) v2:1 LEGO_3706 v2:1]
[S] Bonded39 [LEGO_(axle connector) v2:1 LEGO_3706 v2:1]
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[S] Bonded65 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]
[S] Bonded66 [LEGO_(axle connector) v2:1 LEGO_3706 v2:1]
[S] Bonded67 [LEGO_(axle connector) v2:1 LEGO_3706 v2:1]
[S] Bonded68 [LEGO_(axle connector) v2:1 LEGO_3706 v2:1]
[S] Bonded69 [LEGO_(axle connector) v2:1 LEGO_3706 v2:1]
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[S] Bonded79 [LEGO_(axle connector) v2:1 LEGO_3706 v2:1]
[S] Bonded80 [LEGO_(axle connector) v2:1 LEGO_3706 v2:1]
[S] Bonded81 [LEGO_(axle connector) v2:1 LEGO_4519 v2:1]

[-] **Mesh**

Type	Nodes	Elements
Solids	1012318	657642

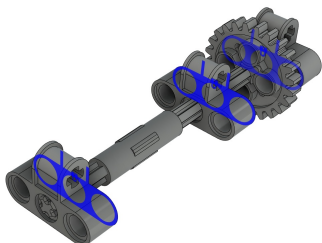
[-] **Load Case1**

[-] **Constraints**

[-] **Fixed1**

Type	Fixed
Ux	Yes
Uy	Yes
Uz	Yes

[-] **Selected Entities**

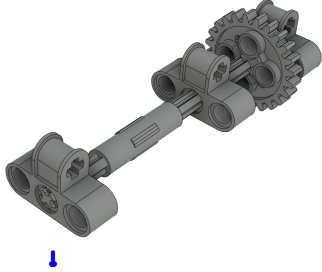


Loads

Gravity

Type	Gravity
Magnitude	9.807 m / s ²
X Value	0 m / s ²
Y Value	0 m / s ²
Z Value	-9.807 m / s ²

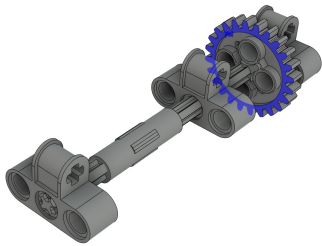
Selected Entities



Moment1

Type	Moment
Magnitude	450 N mm
X Value	-1.217E-12 N mm
Y Value	450 N mm
Z Value	-5.608E-13 N mm

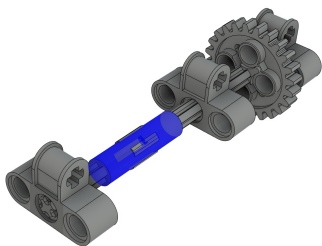
Selected Entities



Moment2

Type	Moment
Magnitude	-450 N mm
X Value	6.662E-13 N mm
Y Value	450 N mm
Z Value	-2.108E-12 N mm

Selected Entities



Results


Result Summary

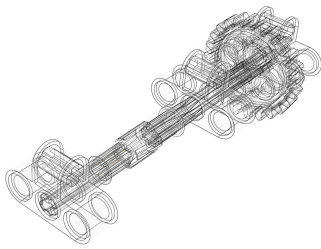
Name	Minimum	Maximum
Safety Factor		
Safety Factor (Per Body)	0.3226	15

Stress		
Von Mises	2.811E-04 MPa	168.6 MPa
1st Principal	-149.1 MPa	203.2 MPa
3rd Principal	-268.9 MPa	89.86 MPa
Normal XX	-159.3 MPa	180 MPa
Normal YY	-157.1 MPa	95.1 MPa
Normal ZZ	-258.7 MPa	105.7 MPa
Shear XY	-31.69 MPa	43.07 MPa
Shear YZ	-26.48 MPa	34.99 MPa
Shear ZX	-51.02 MPa	48.48 MPa
Displacement		
Total	0 mm	0.2288 mm
X	-0.2202 mm	0.2203 mm
Y	-0.03676 mm	0.03662 mm
Z	-0.2242 mm	0.2241 mm
Reaction Force		
Total	0 N	7.704 N
X	-2.452 N	2.939 N
Y	-7.64 N	6.468 N
Z	-2.135 N	2.026 N
Strain		
Equivalent	1.751E-07	0.08199
1st Principal	-1.694E-05	0.08566
3rd Principal	-0.06735	2.096E-04
Normal XX	-0.02611	0.04867
Normal YY	-0.01514	0.01508
Normal ZZ	-0.04753	0.02309
Shear XY	-0.03192	0.04338
Shear YZ	-0.02667	0.03524
Shear ZX	-0.05139	0.04883
Contact Pressure		
Total	0 MPa	140.9 MPa
X	-87.89 MPa	133.8 MPa
Y	-66.77 MPa	87.25 MPa
Z	-66.69 MPa	51.68 MPa

Safety Factor

Safety Factor (Per Body)

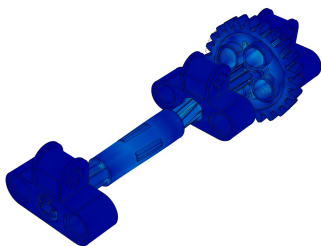
0  8, Threshold: 0 - 1.1



Stress

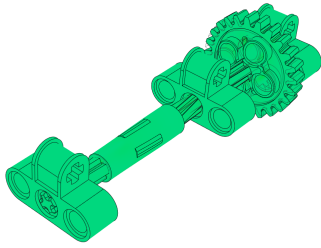
Von Mises

[MPa] 0  168.6



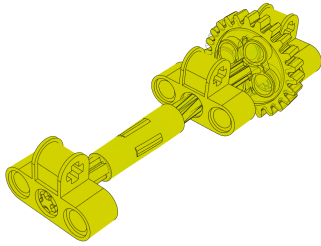
1st Principal

[MPa] -149.1  203.2



☐ **3rd Principal**

[MPa] -268.9  89.9



☐ **Displacement**

☐ **Total**

[mm] 0  0.2288

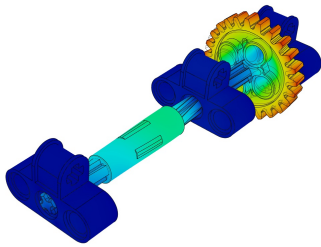


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