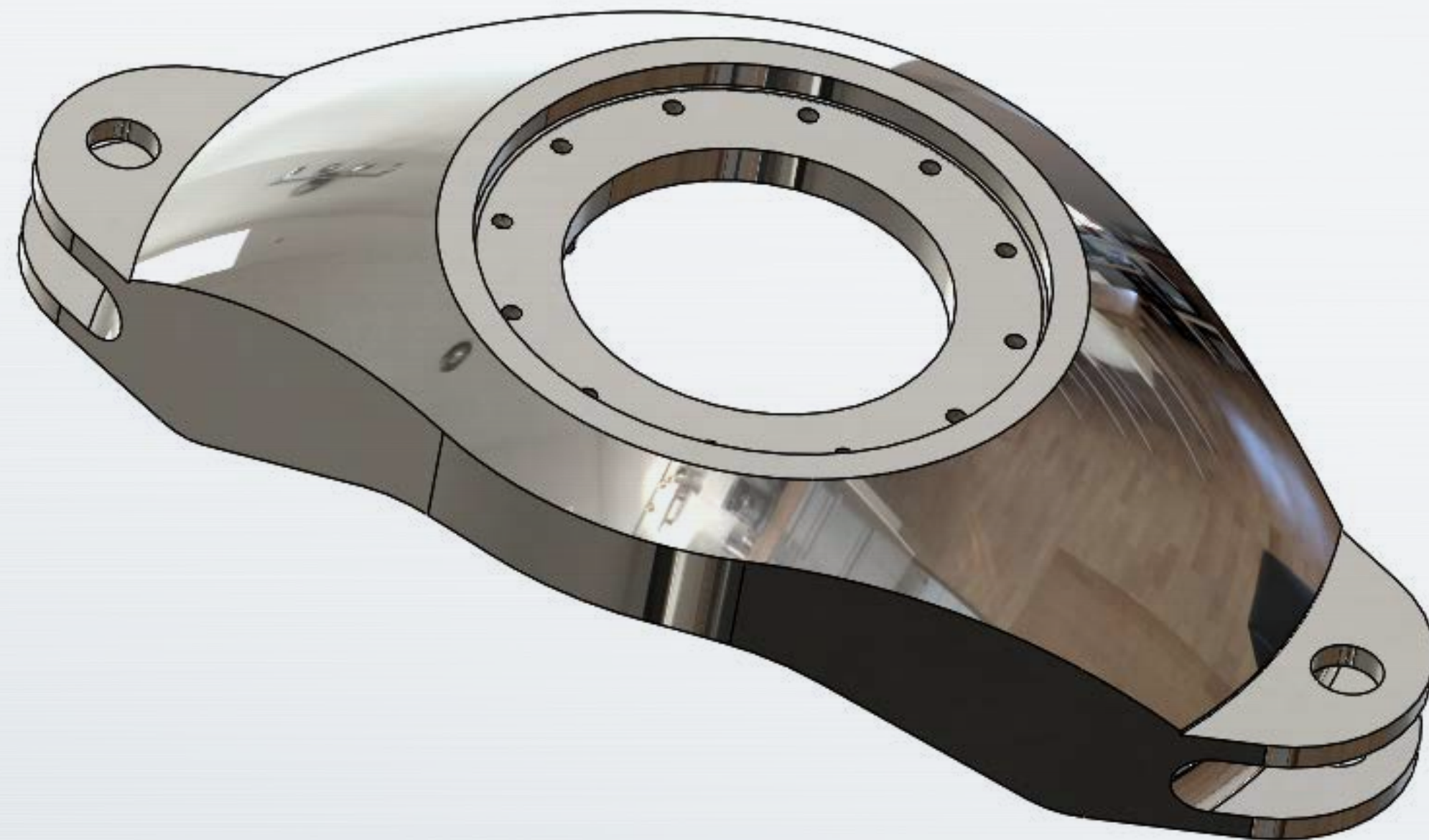


Sling Coupling: FEM Analysis

Comparison Electrowelded vs Molten



Cast steel EN-GJS-400-15 (GGG40)

Tensile breaking strength: $R_m = 370 \text{ MPa}$

Tensile yield strength: $R_e = 250 \text{ MPa}$

Modulus of elasticity: $E = 169\,000 \text{ MPa}$

Poisson's ratio: $\mu = 0.28$

Properties Tables & Curves Appearance CrossHatch Custom Application Dat

Material properties
Materials in the default library can not be edited. You must first copy the material to a custom library to edit it.

Model Type: Linear Elastic Isotropic

Units: SI - N/mm² (MPa)

Category: Sling_Coupling

Name: Cast_Iron_EN_GJS_400_15

Default failure criterion: Max von Mises Stress

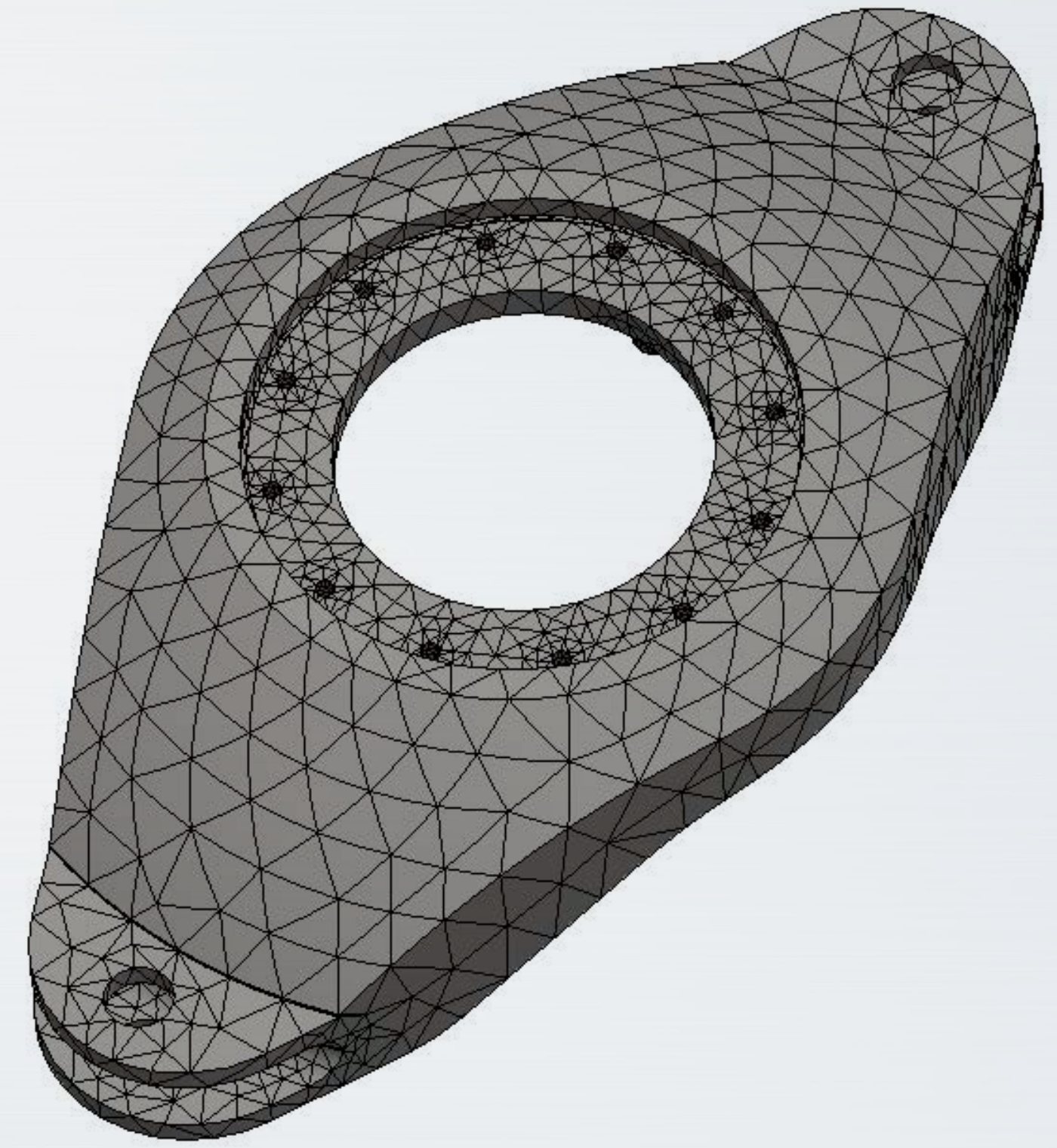
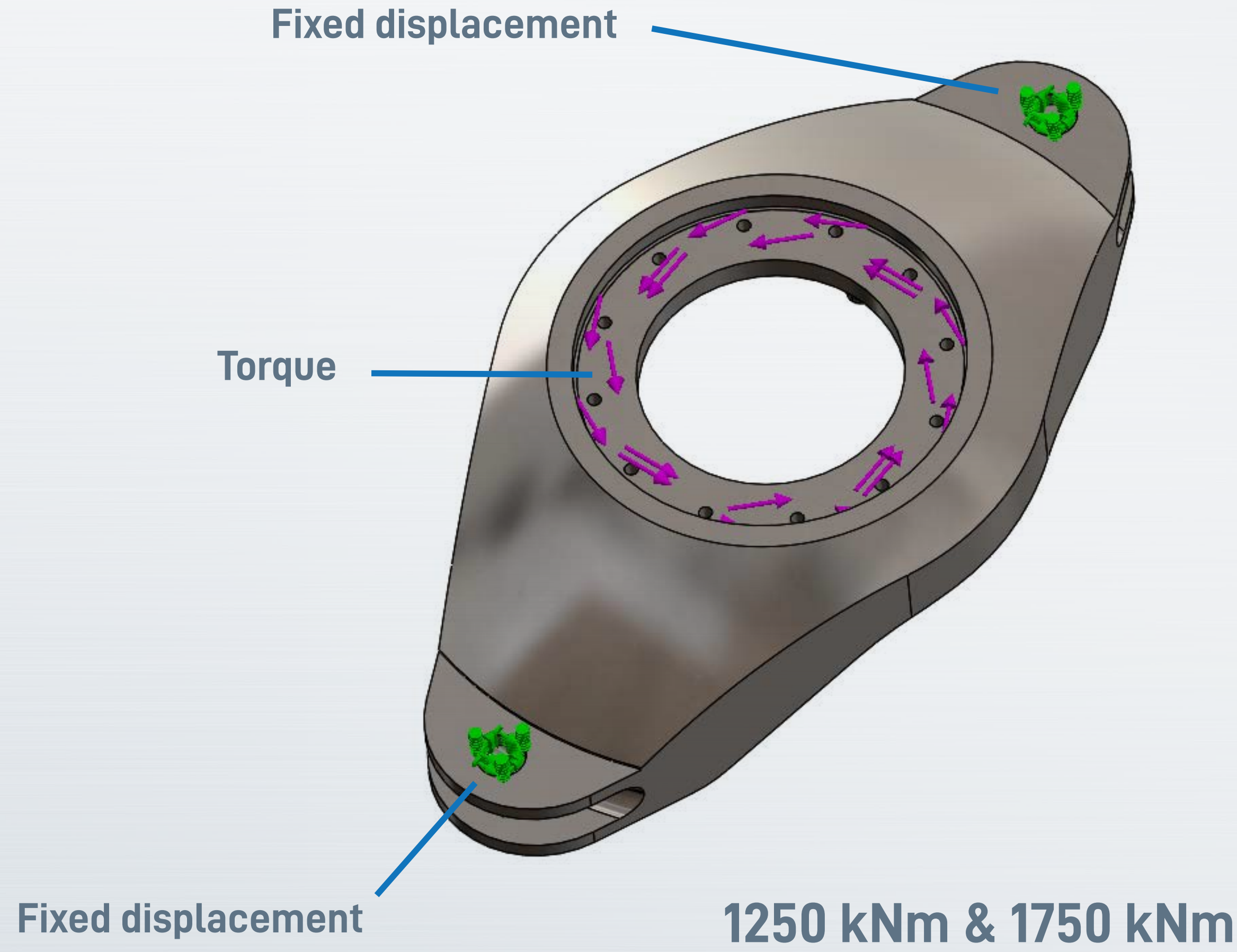
Description: Cast Iron Alloy - GGG40

Source: <http://www.dijkkamp.nl/en/materials/ggg40-en-gjs->

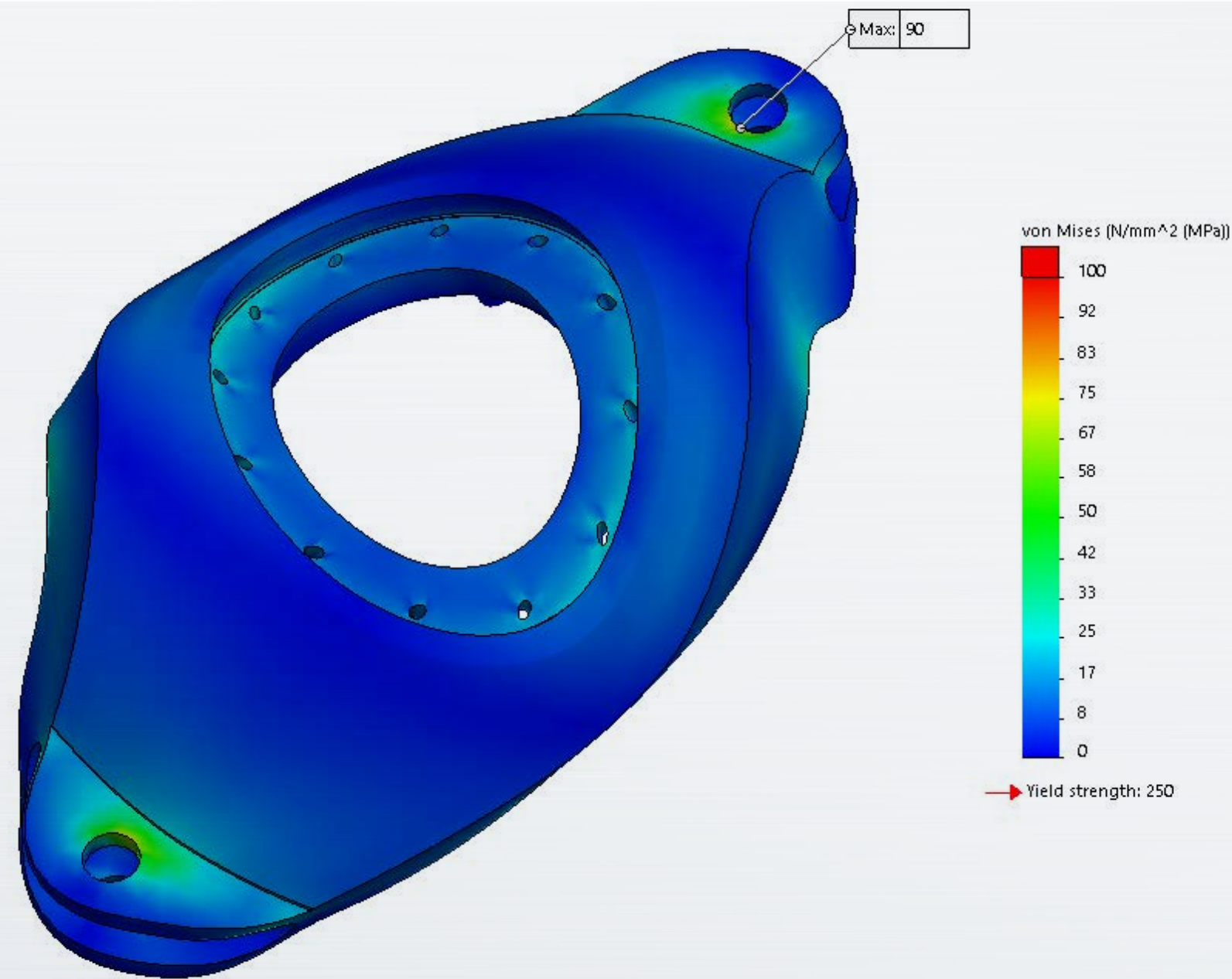
Sustainability: Alloy Steel in SOLIDWORKS Materials Select...

Property	Value	Units
Elastic Modulus	169000	N/mm ²
Poisson's Ratio	0.28	N/A
Shear Modulus	79000	N/mm ²
Mass Density	7100	kg/m ³
Tensile Strength	370	N/mm ²
Compressive Strength		N/mm ²
Yield Strength	250	N/mm ²
Thermal Expansion Coefficient	1.3e-05	/K
Thermal Conductivity	50	W/(m·K)

Constraints, Load and Mesh

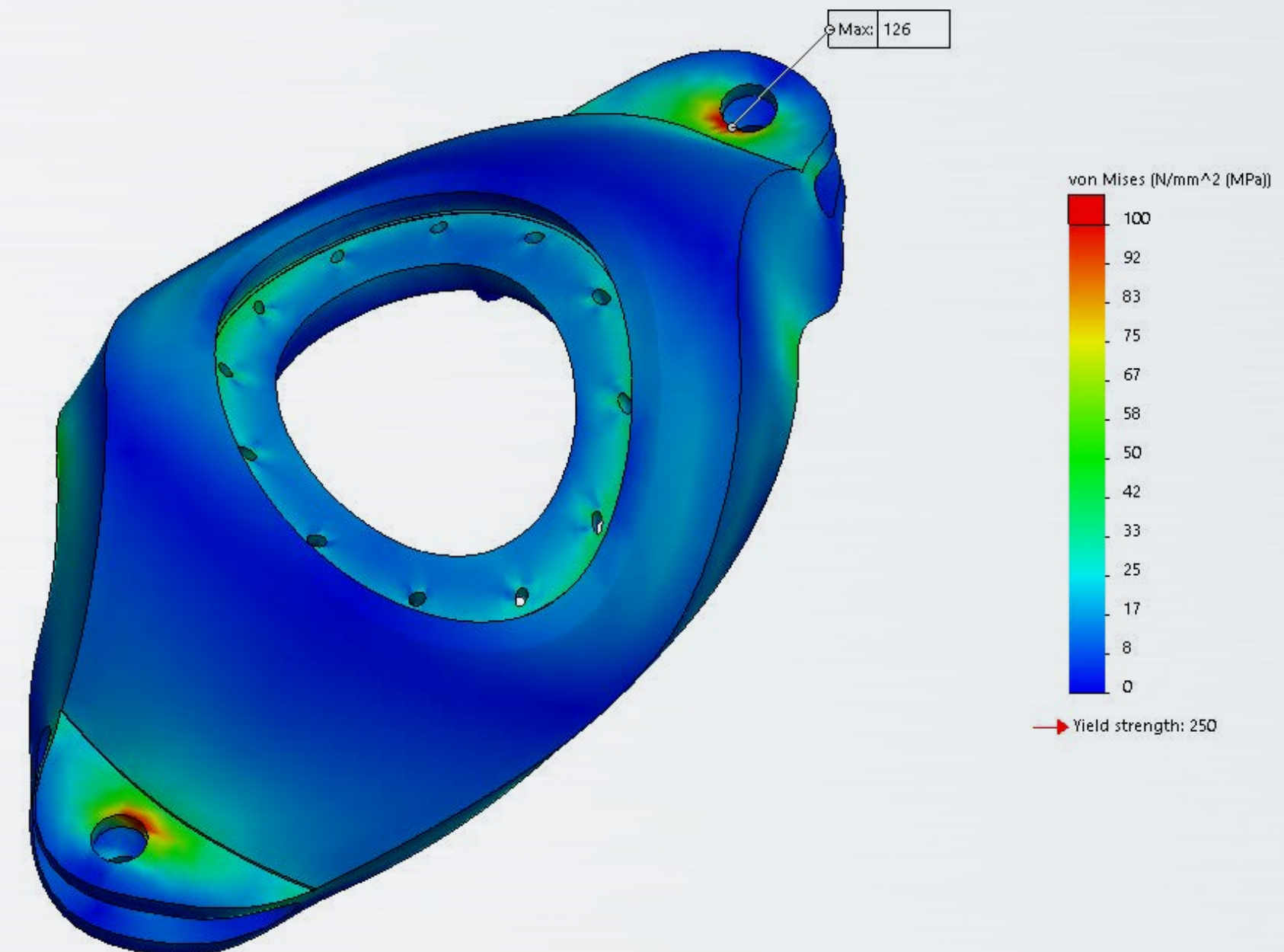


von Mises Stresses for applied Torque



Torque
T = 1250 kNm

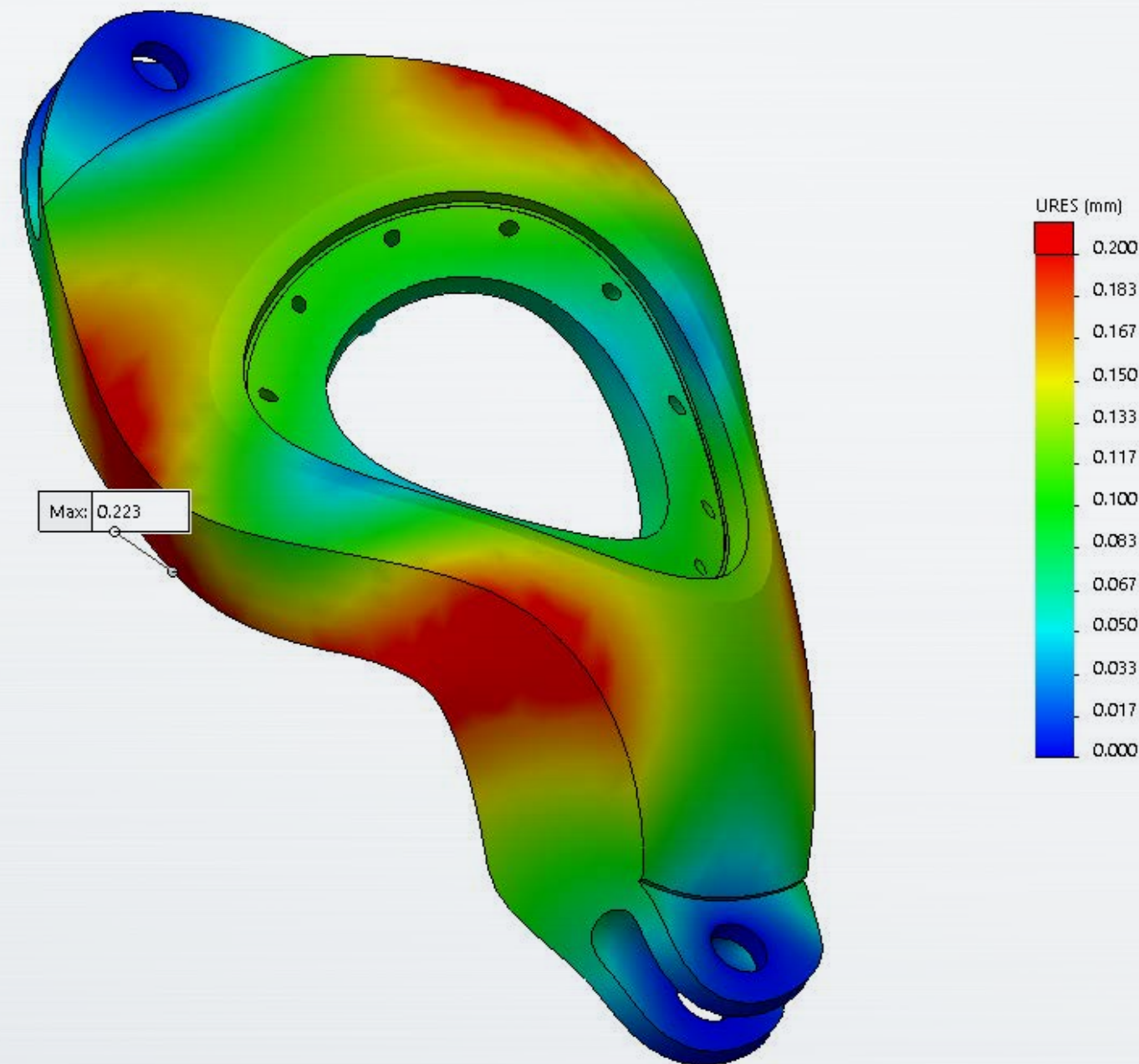
Safety factor
SF = 250/90 = **2.78**
S_{max}/S_{yield} = 90/250 = **36%**



Torque
T = 1750 kNm

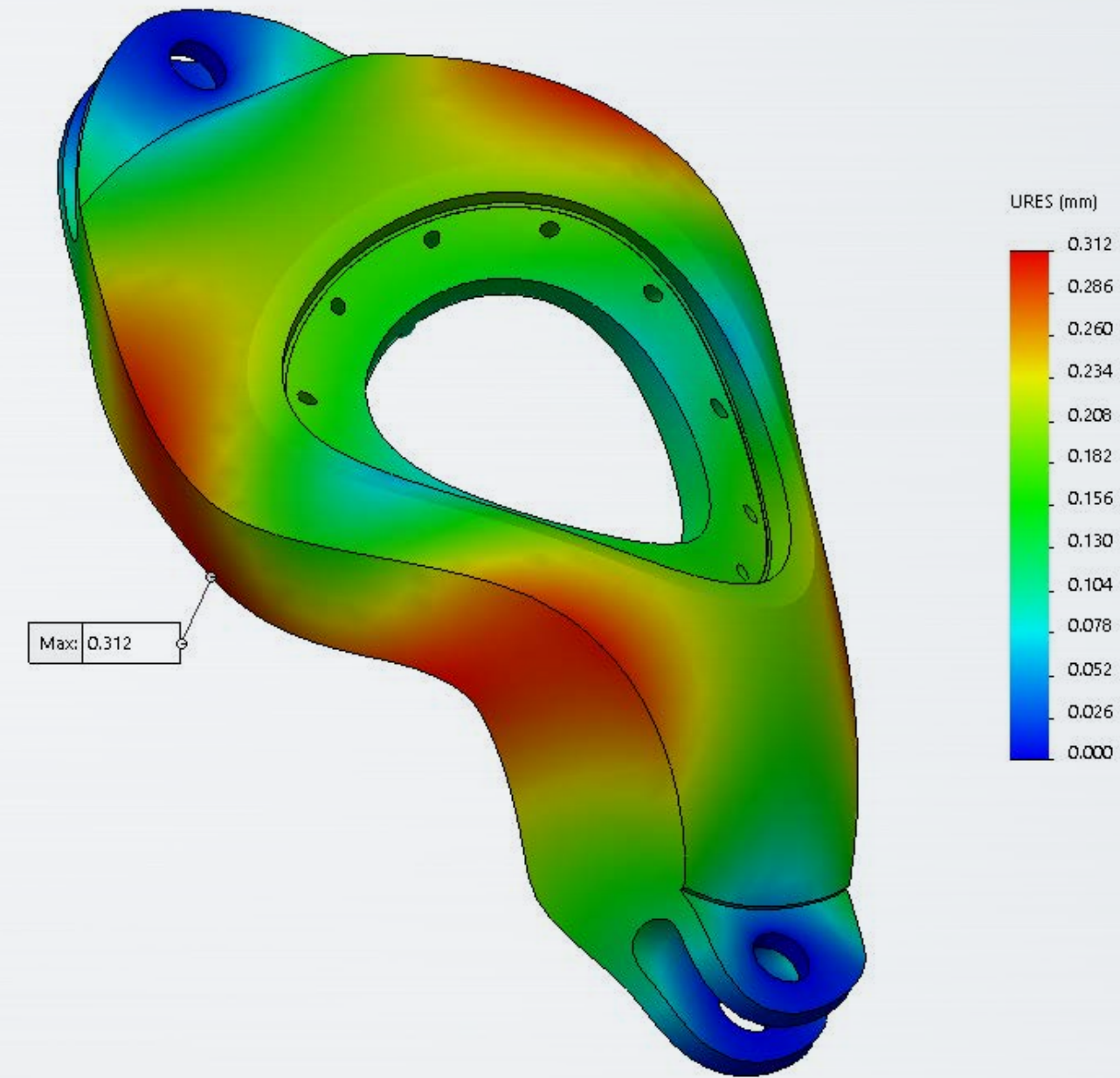
Safety factor
SF = 250/126 = **1.98**
S_{max}/S_{yield} = 126/250 = **50%**

Displacements for applied load



Torque
T = 1250 kNm

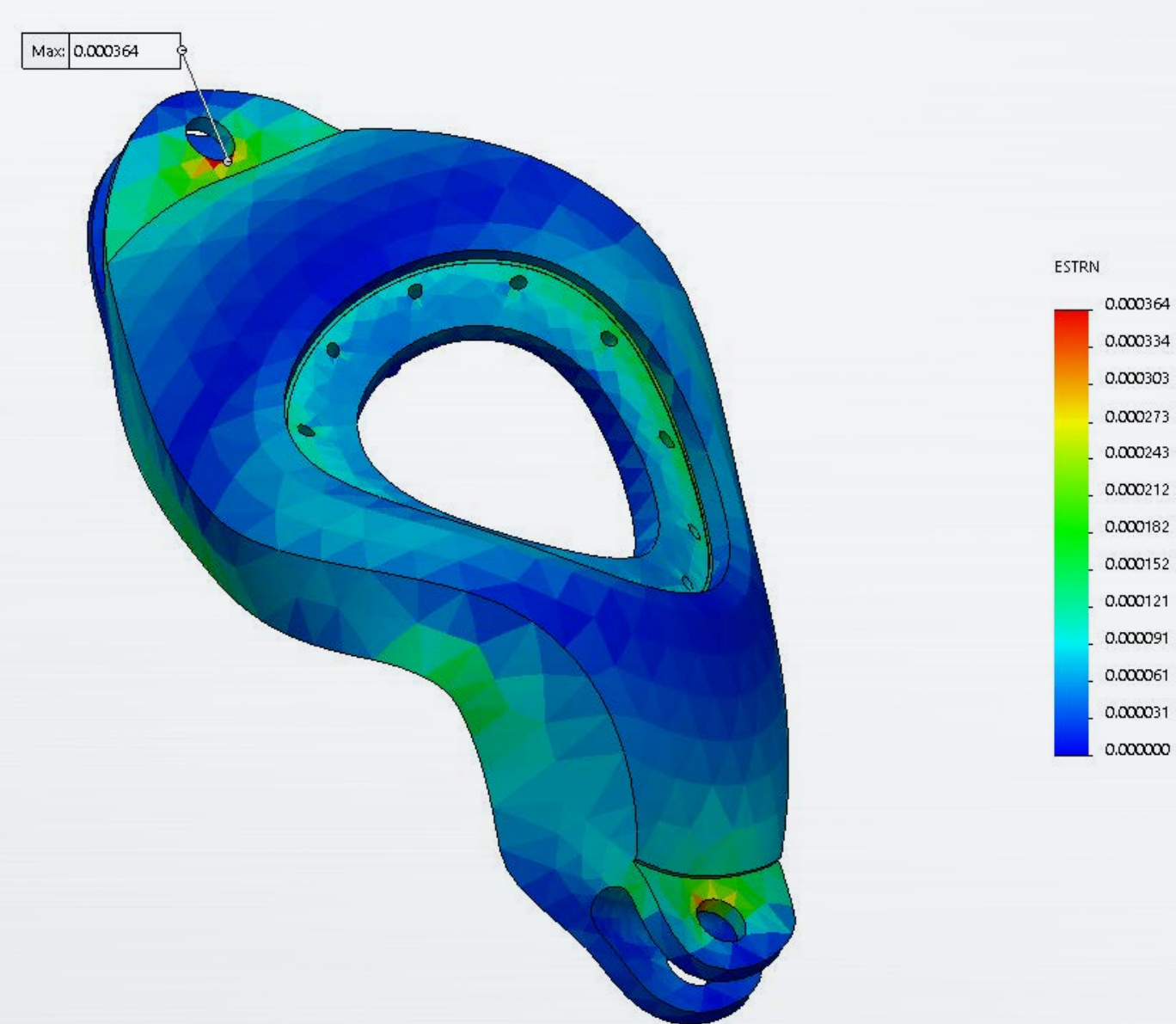
Max Displacement = **0.223 mm**
Deformation scale ~ 1000



Torque
T = 1750 kNm

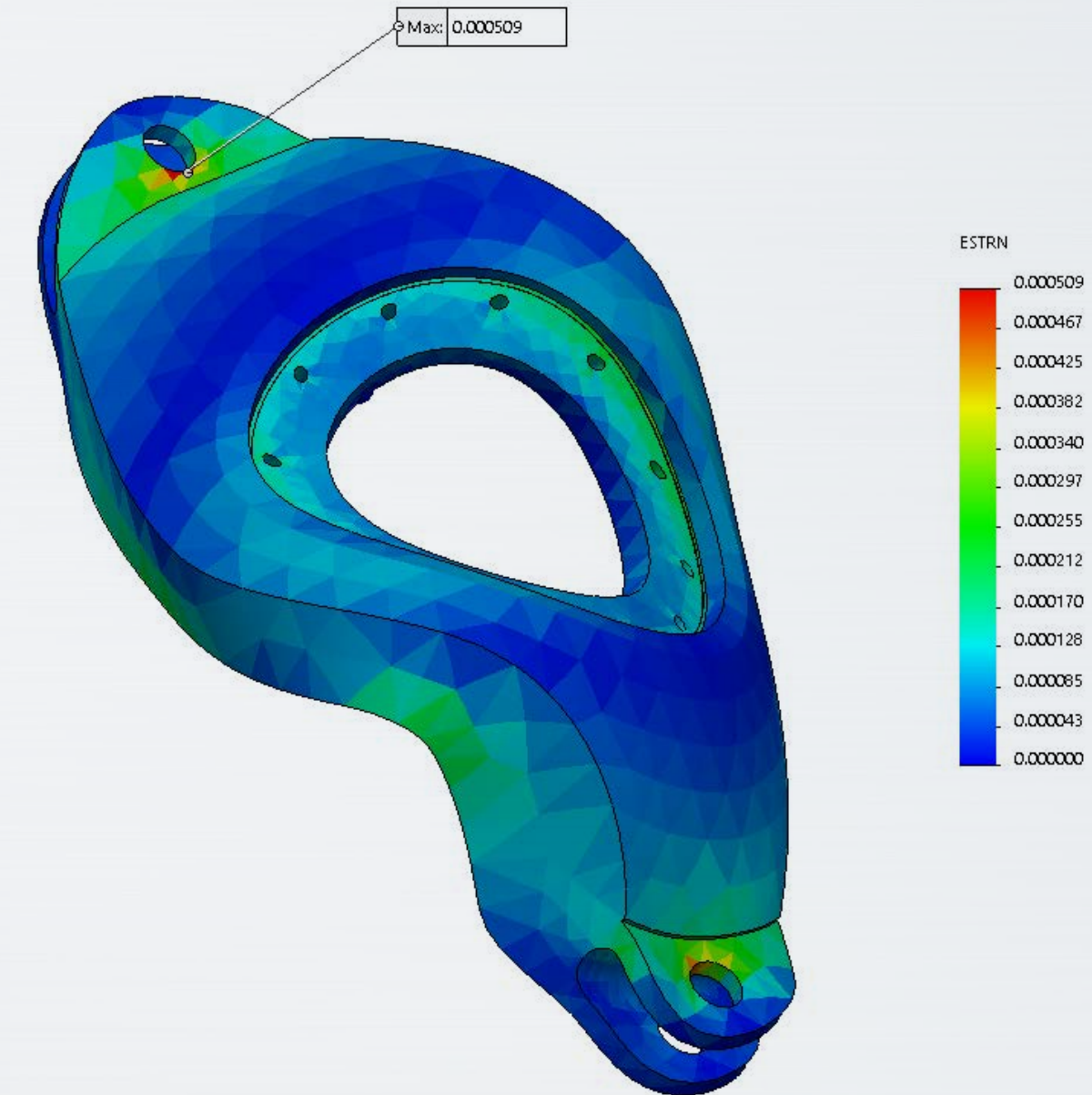
Max Displacement = **0.312 mm**
Deformation scale ~ 1000

Unit strains for applied Torque



Torque
T = 1250 kNm

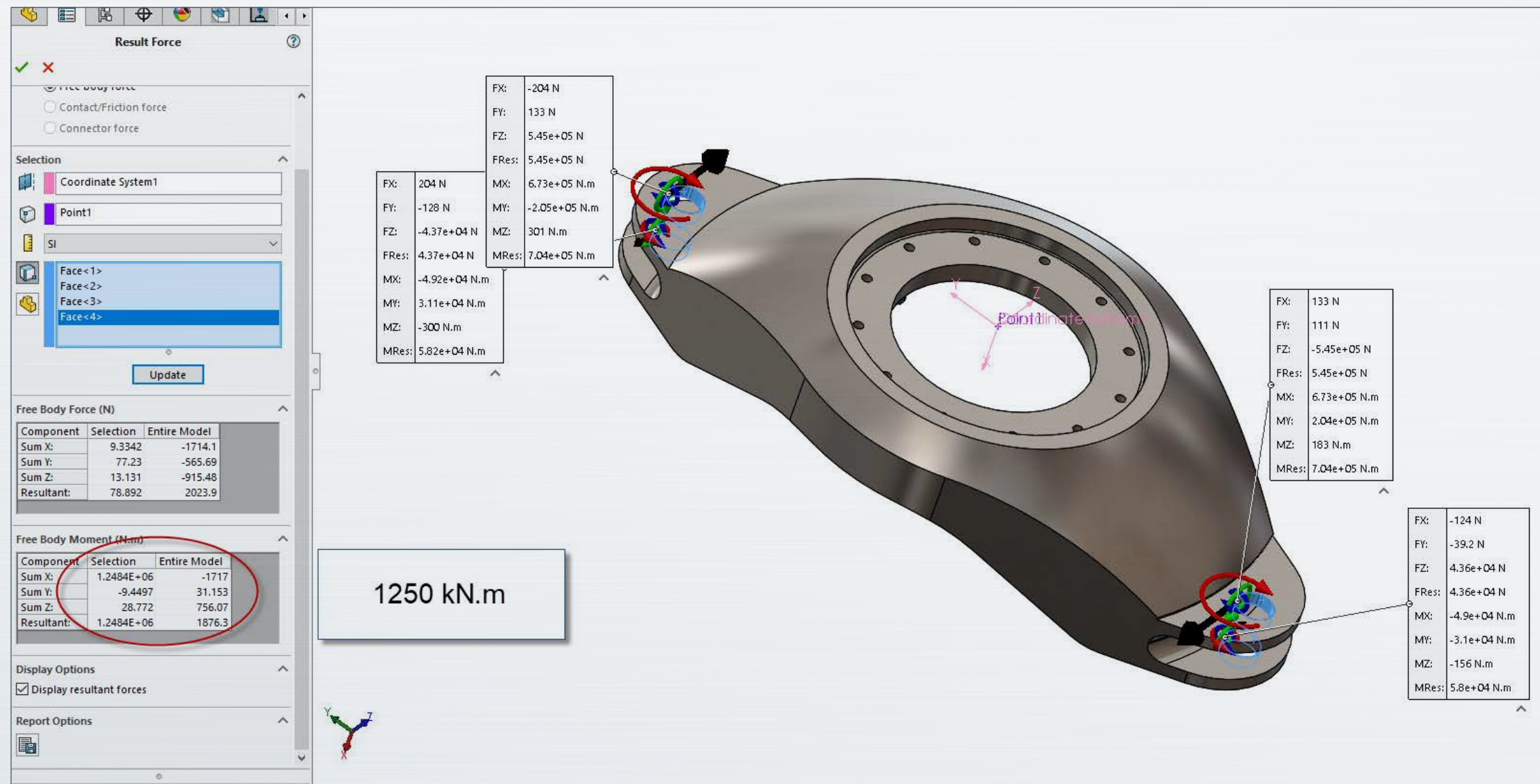
Max Elastic Strain = 0.036%



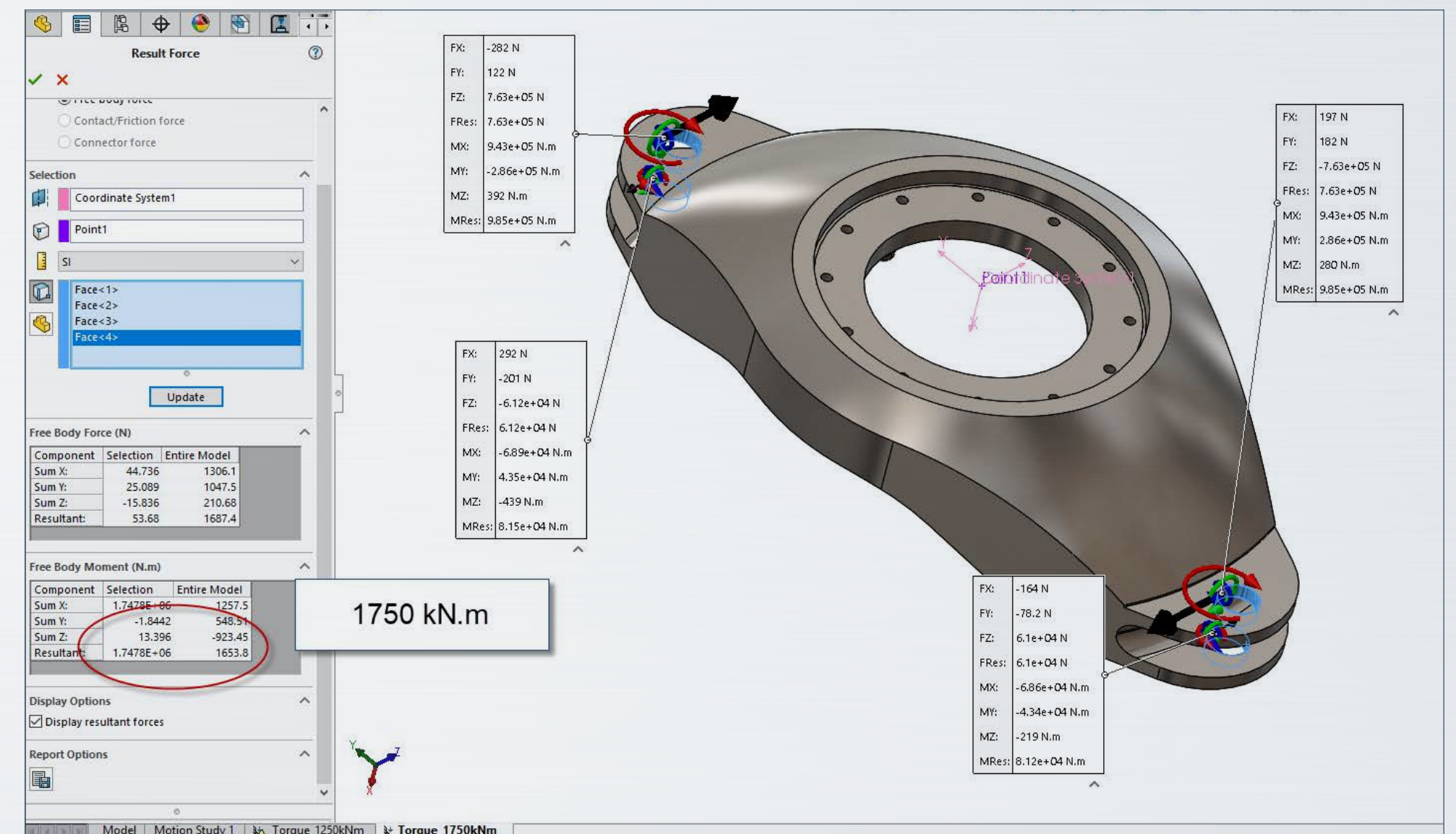
Torque
T = 1750 kNm

Max Elastic Strain = 0.051%

Reaction equilibrium check with applied torque



Torque
 $T = 1250 \text{ kNm}$



Torque
 $T = 1750 \text{ kNm}$

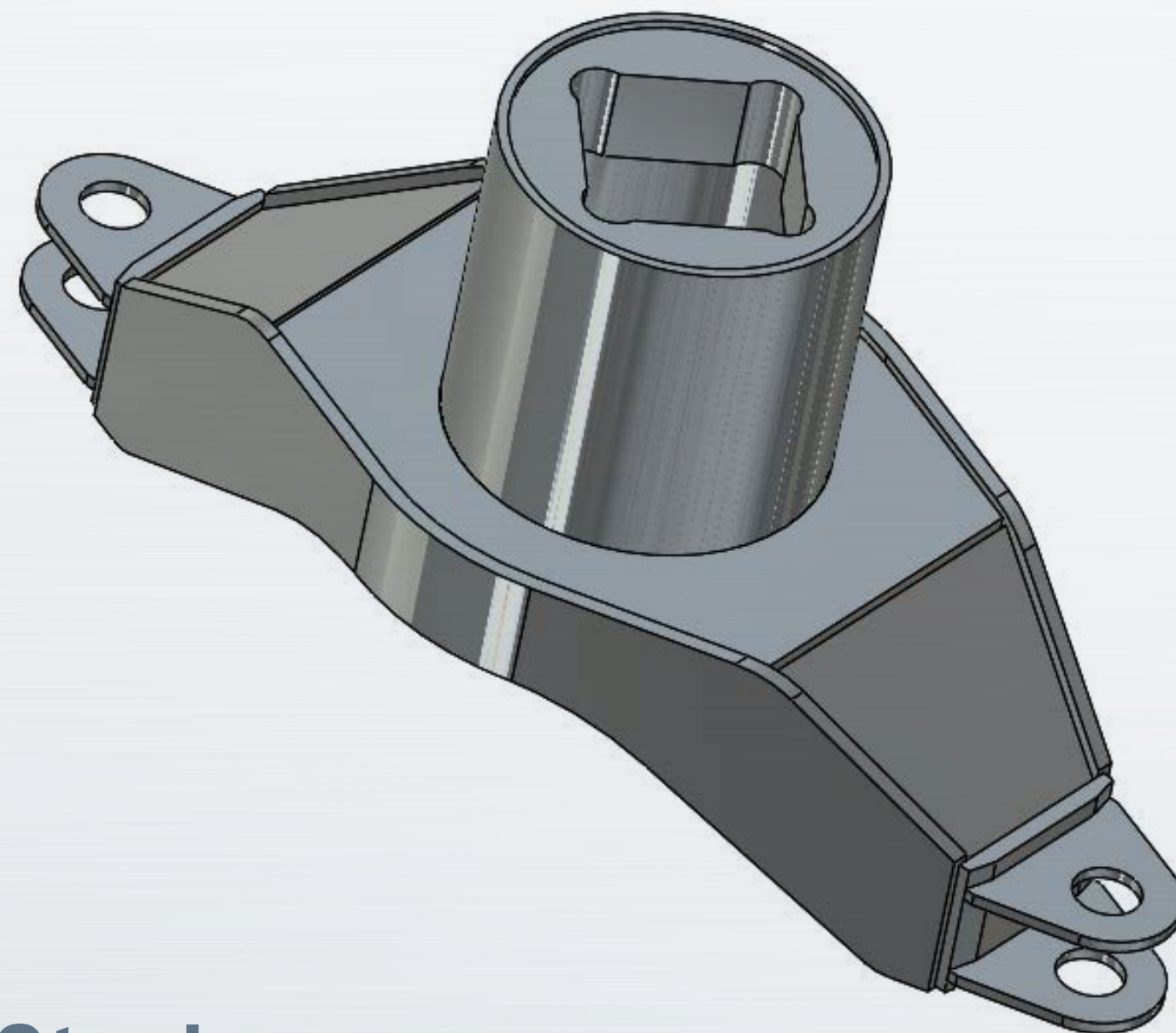
Conclusions

The stress fields found for the torques of **1250 kN.m** and **1750 kN.m** have a factor of safety of 2.78 and 1.98 respectively. .

The analysis performed is linear static, and for these torque levels it can be said that we are in safe operating regions for a yield stress of **250 MPa**.

More advanced analyses on the component can be evaluated for a better understanding of the component under overtorque states. These types of studies include: **Fatigue and Non-Linear**.

Material: A36



Steel

Tensile breaking strength: $R_m = 400 \text{ MPa}$

Tensile yield strength: $R_e = 250 \text{ MPa}$

Modulus of elasticity: $E = 200\,000 \text{ MPa}$

Poisson's ratio: $\mu = 0.26$

Material

- 201 Annealed Stainless Steel (SS)
- A286 Iron Base Superalloy
- AISI 1010 Steel, hot rolled bar
- AISI 1015 Steel, Cold Drawn (SS)
- AISI 1020
- AISI 1020 Steel, Cold Rolled
- AISI 1035 Steel (SS)
- AISI 1045 Steel, cold drawn
- AISI 304
- AISI 316 Annealed Stainless Steel Ba
- AISI 316 Stainless Steel Sheet (SS)
- AISI 321 Annealed Stainless Steel (S)
- AISI 347 Annealed Stainless Steel (S)
- AISI 4130 Steel, annealed at 865C
- AISI 4130 Steel, normalized at 870C
- AISI 4340 Steel, annealed
- AISI 4340 Steel, normalized
- AISI Type 316L stainless steel
- AISI Type A2 Tool Steel
- Alloy Steel
- Alloy Steel (SS)
- ASTM A36 Steel**
- Cast Alloy Steel

Properties | Tables & Curves | Appearance | CrossHatch | Custom | Application Dat

Material properties
Materials in the default library can not be edited. You must first copy the material to a custom library to edit it.

Model Type:

Units:

Category:

Name:

Default failure criterion:

Description:

Source:

Sustainability:

Property	Value	Units
Elastic Modulus	200000	N/mm^2
Poisson's Ratio	0.26	N/A
Shear Modulus	79300	N/mm^2
Mass Density	7850	kg/m^3
Tensile Strength	400	N/mm^2
Compressive Strength		N/mm^2
Yield Strength	250	N/mm^2
Thermal Expansion Coefficient		/K
Thermal Conductivity		W/(m·K)

Click [here](#) to access more materials using the SOLIDWORKS Materials Web Portal.

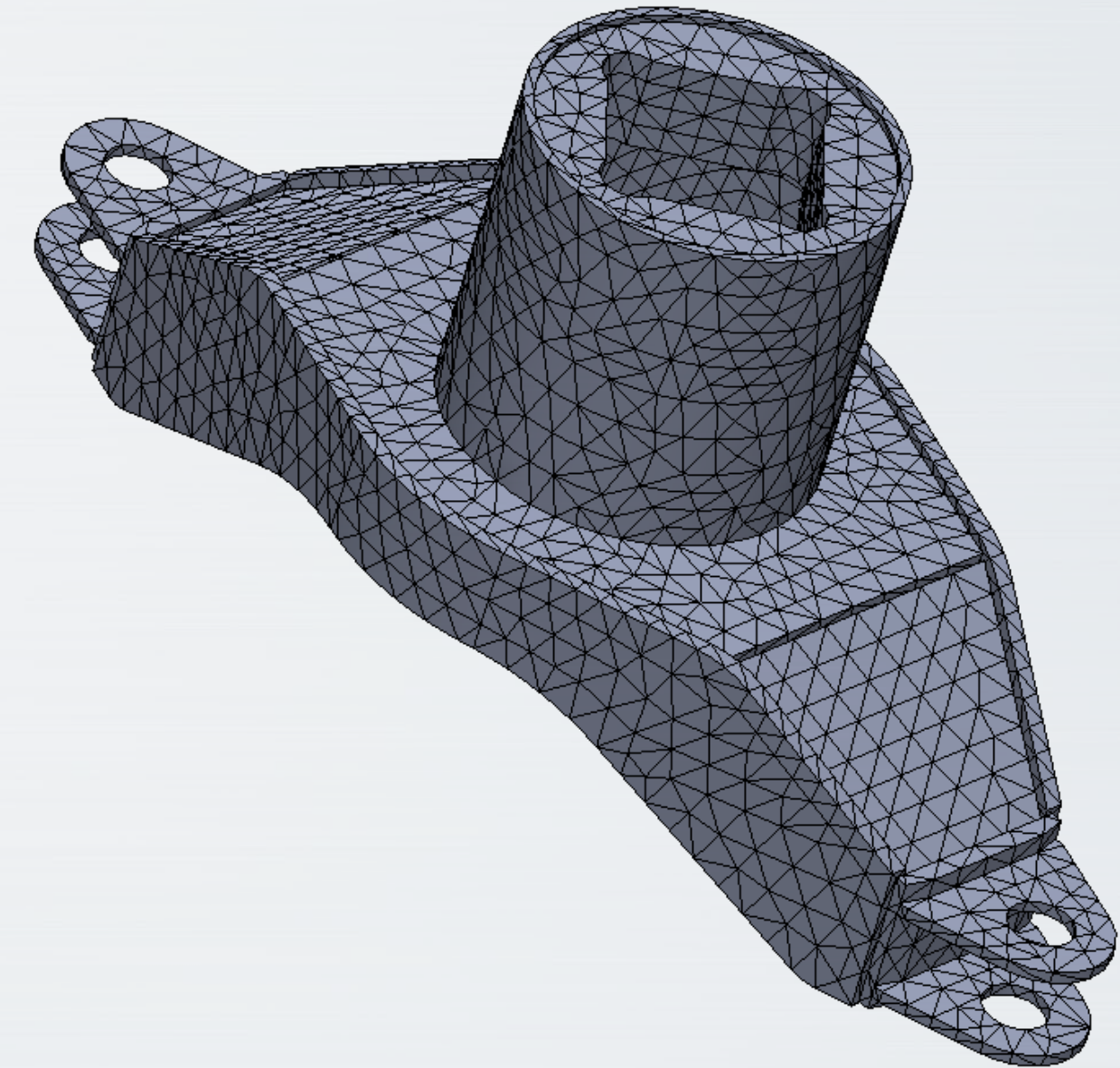
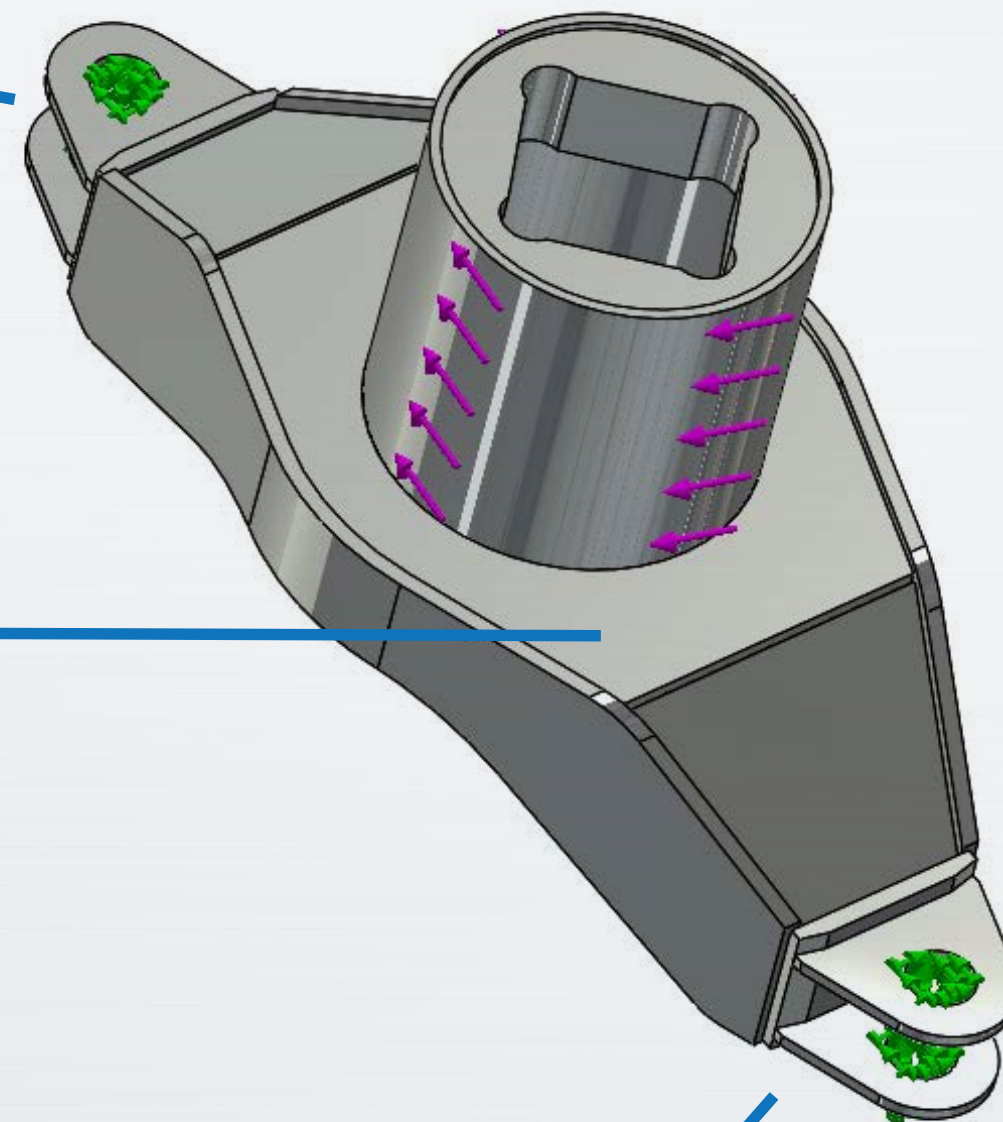
Open...

Constraints, Load and Mesh

Fixed displacement

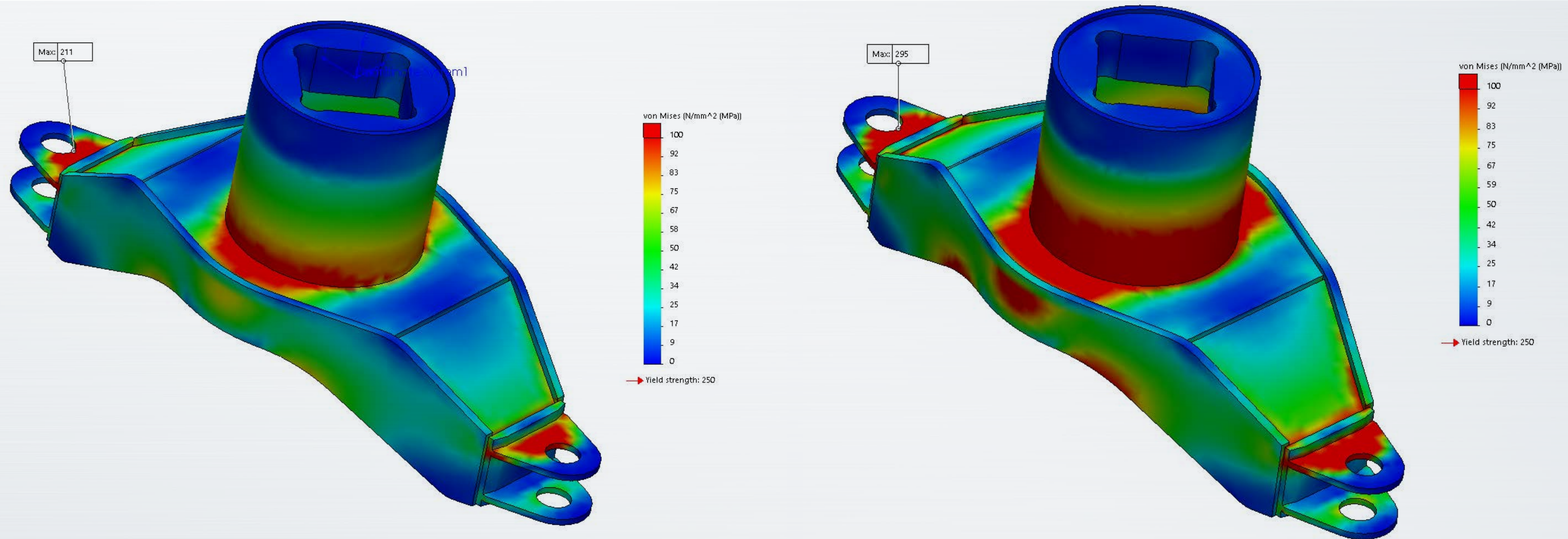
Torque

Fixed displacement



1250 kNm & 1750 kNm

von Mises Stresses for applied Torque



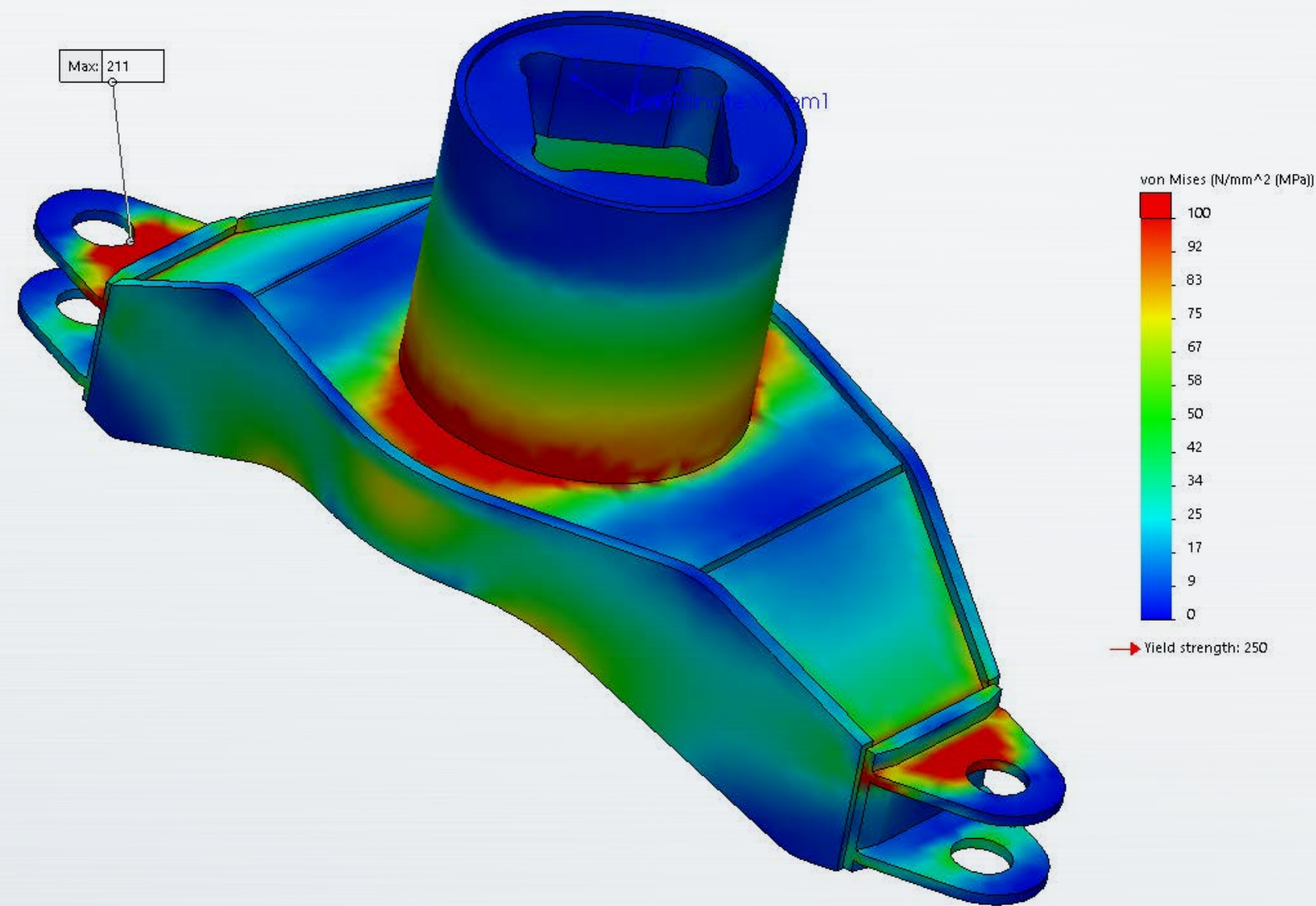
Torque
T = 1250 kNm

Safety factor
SF = $250/211 = 1.18$
S_{max}/S_{yield} = $208/250 = 84\%$

Torque
T = 1750 kNm

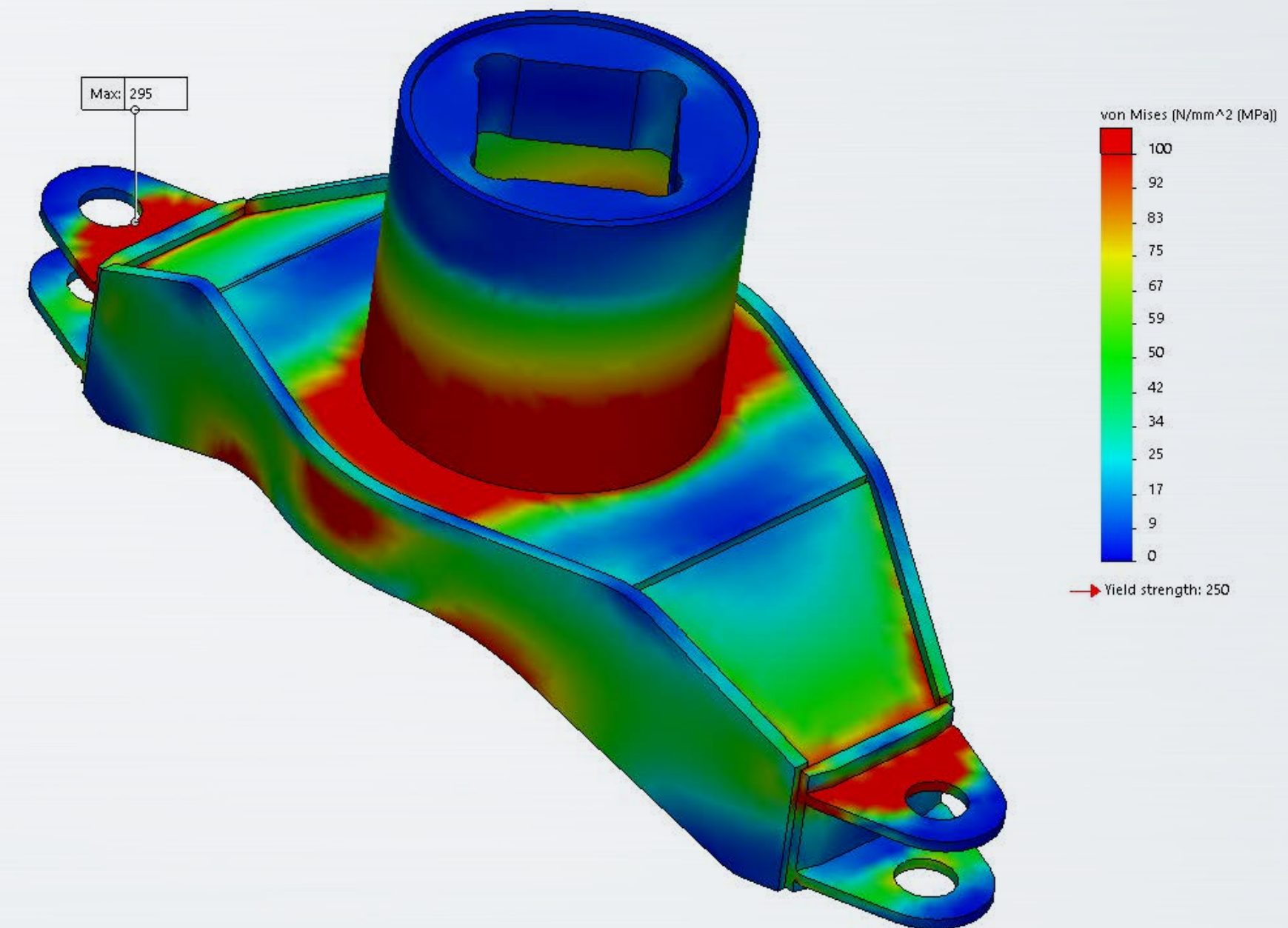
Safety factor
SF = $250/295 = 0.85$
S_{max}/S_{yield} = $295/250 = 118\%$

Displacements for applied Torque



Torque
T = 1250 kNm

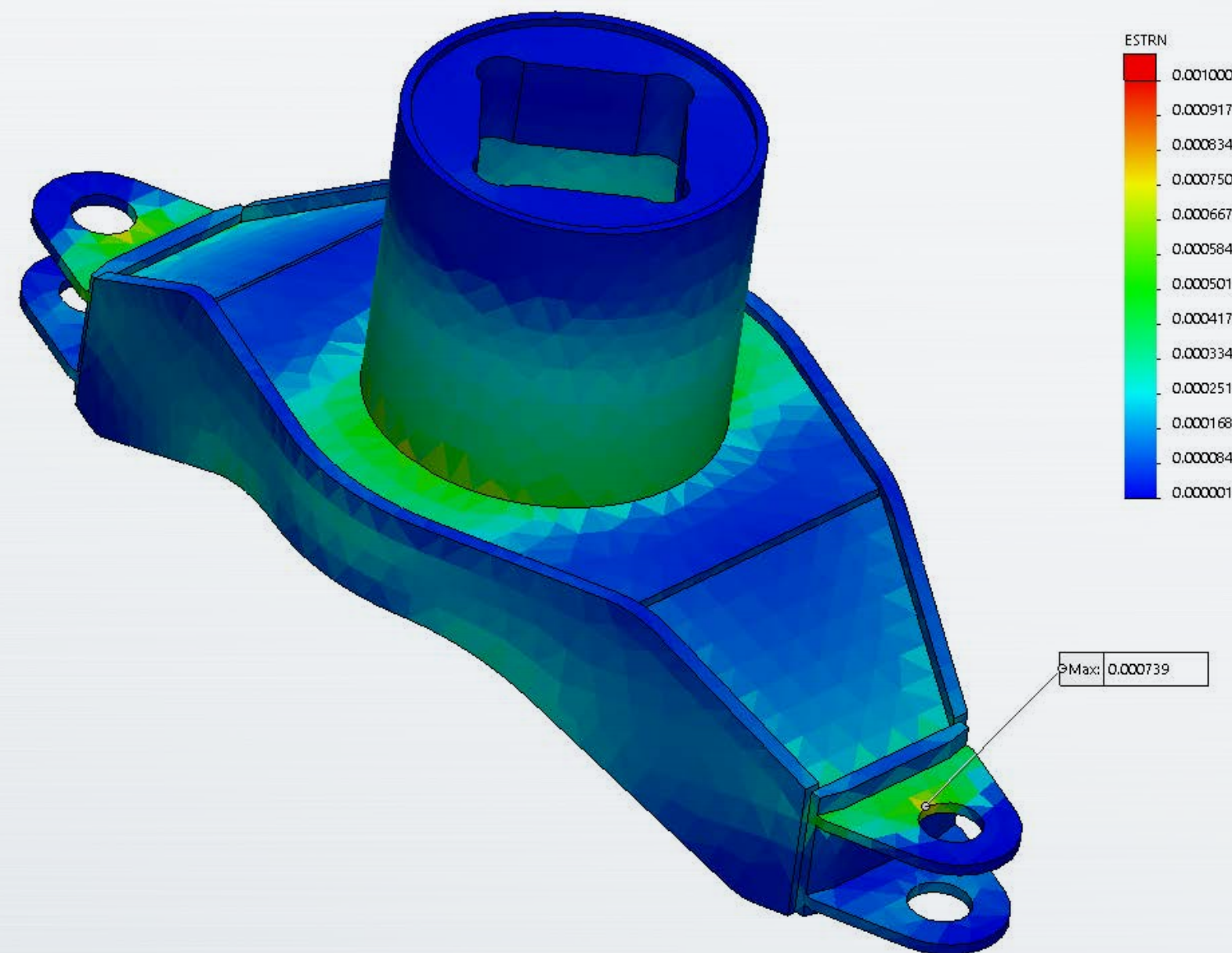
Max Displacement = 0.539 mm



Torque
T = 1750 kNm

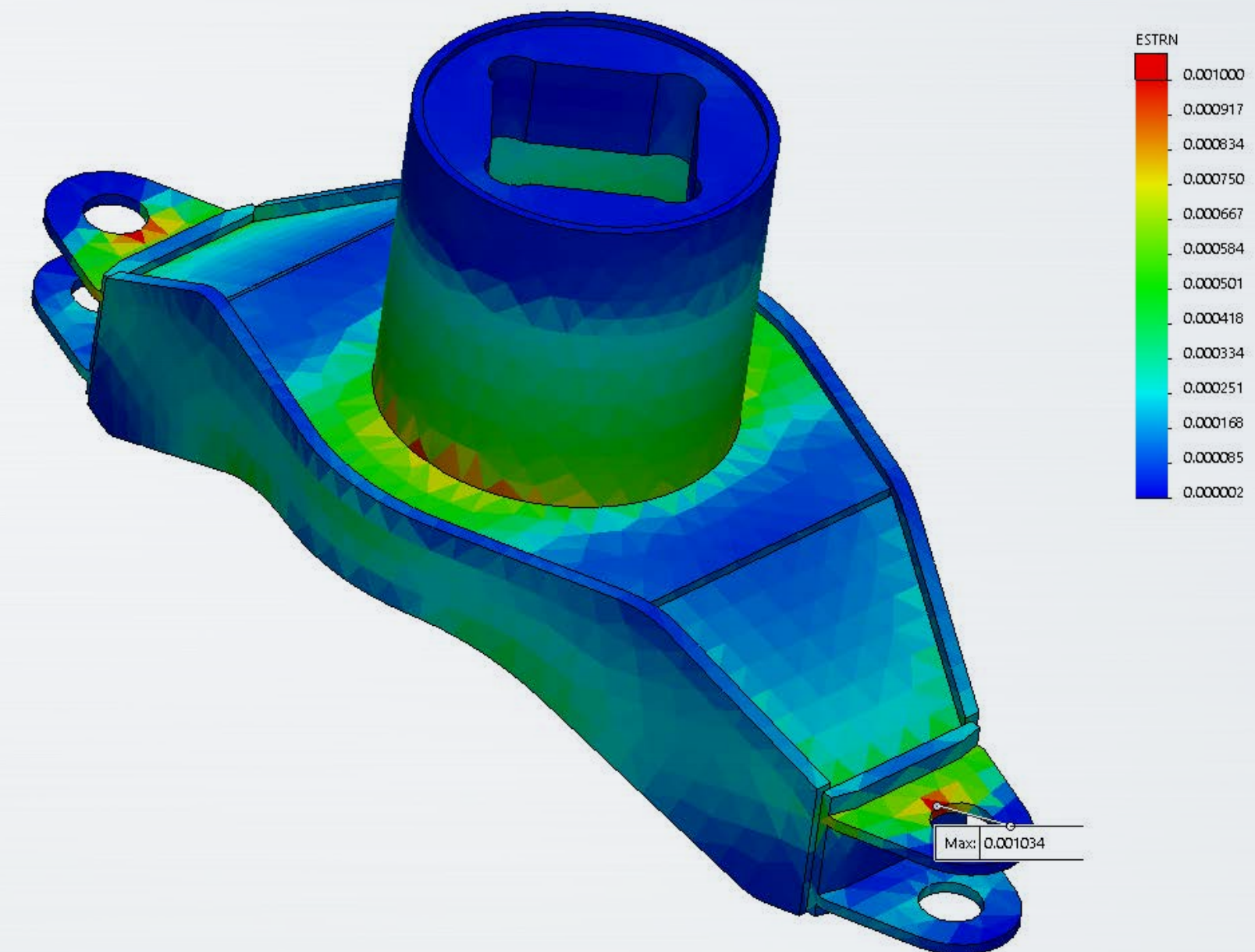
Max Displacement = 0.755 mm

Unit strains for applied Torque



Torque
 $T = 1250 \text{ kNm}$

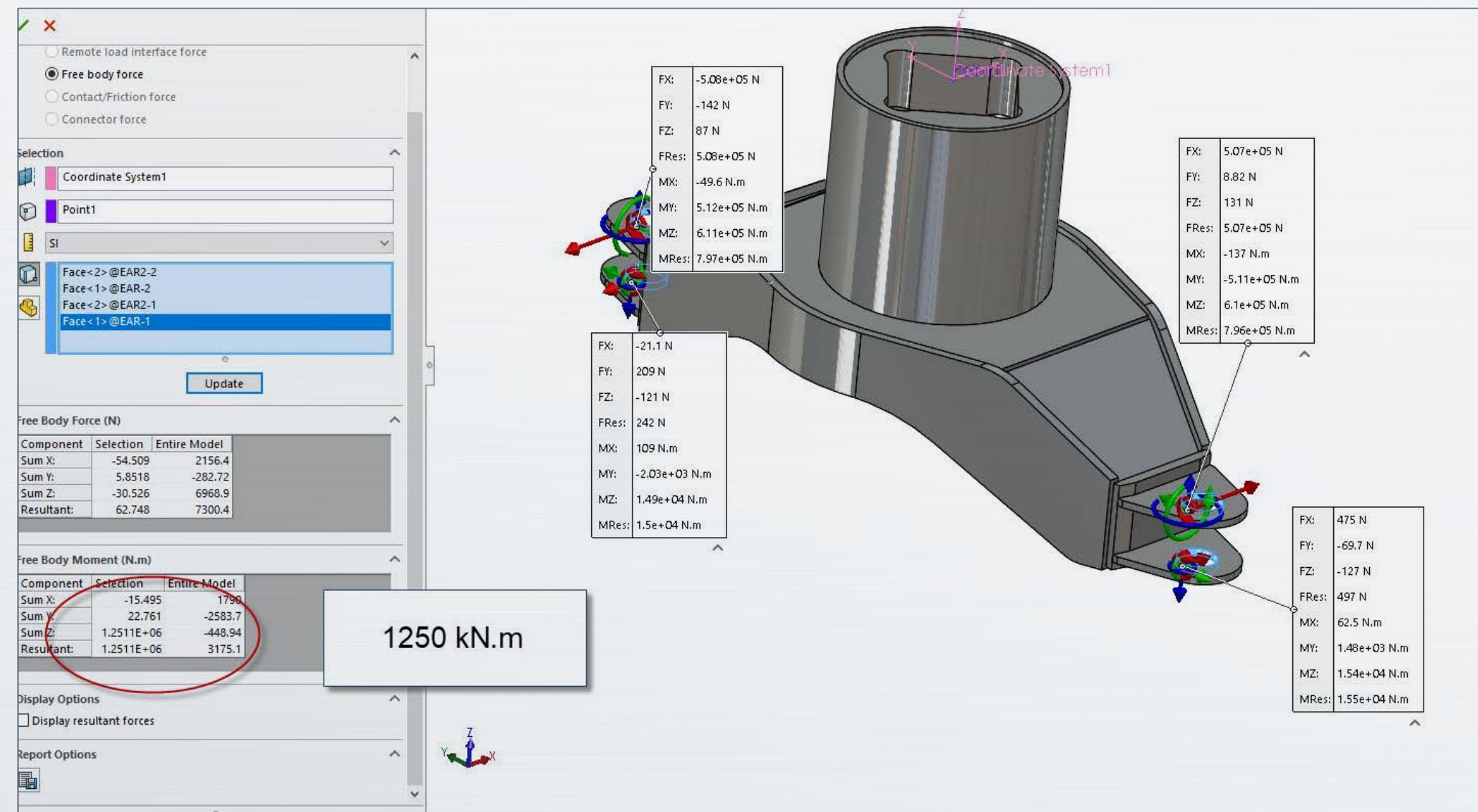
Max Elastic Strain = 0.071%



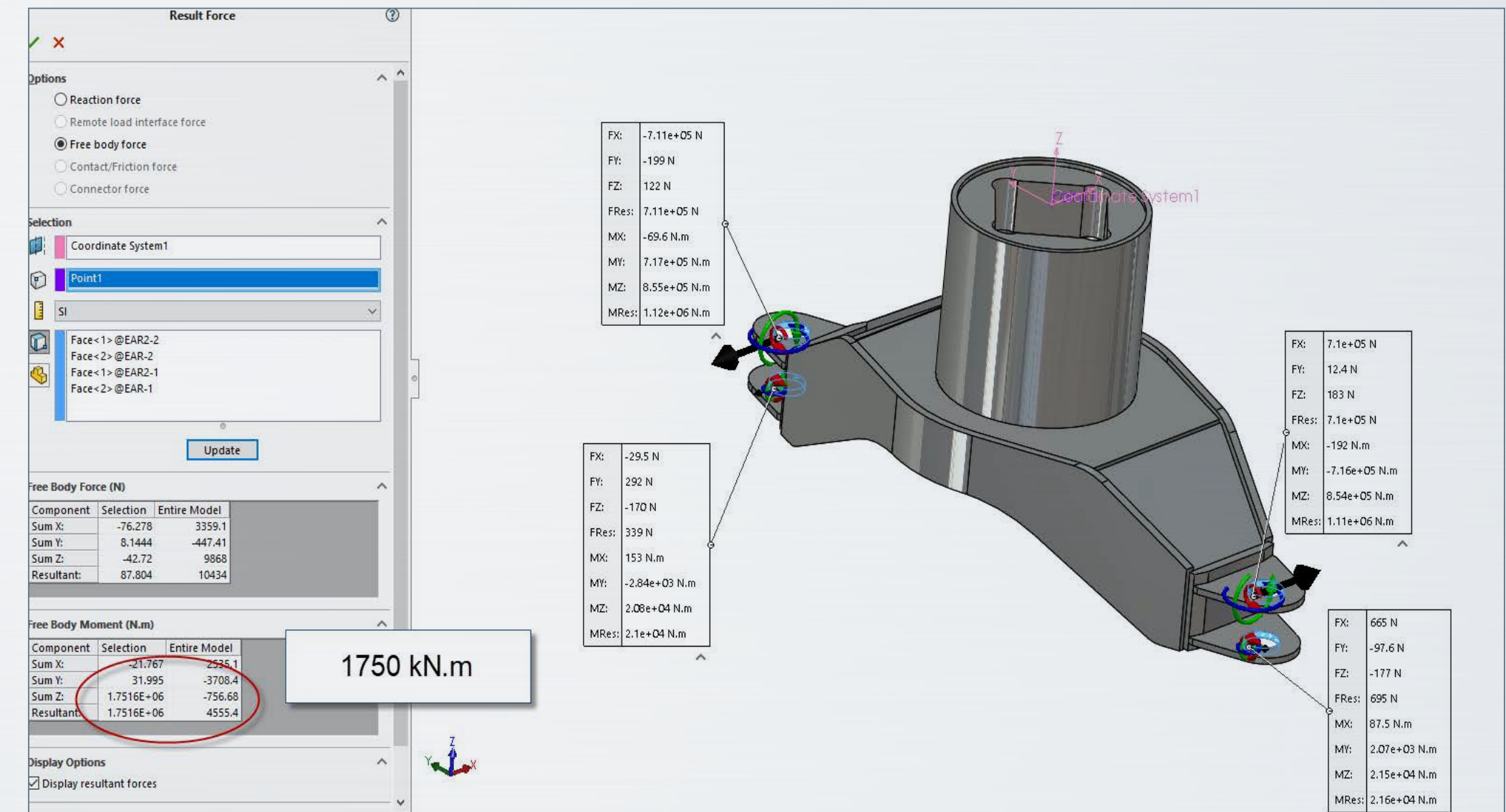
Torque
 $T = 1750 \text{ kNm}$

Max Elastic Strain = 0.103%

Unit strains for applied Torque



Torque
 $T = 1250 \text{ kNm}$



Torque
 $T = 1750 \text{ kNm}$

Conclusions

The stress fields found for the **1250 kN.m** and **1750 kN.m** torques have a factor of safety of 1.20 and 0.86 respectively.

The analysis performed is linear static, and for those levels of torque it can be said that we find **NOT safe** regions for a yield stress of 250 MPa.

More advanced analyses on the component can be evaluated for a better understanding of the component under overtorque states.
These types of studies include: Fatigue and Nonlinear.