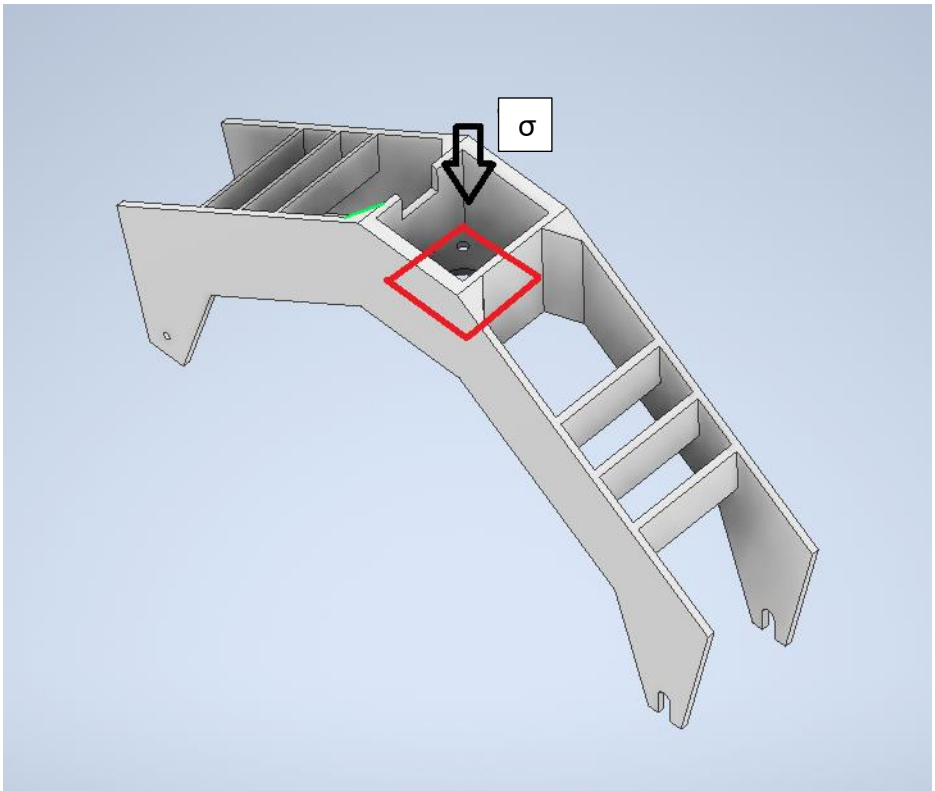
Motor Bridge

Pressure applied

The pressure applied to the base of the bridge will be the result of the division between the weight of the Nema 17 motor in Newtons and the contact surface between it and its support base. Knowing that the motor weighs 300g and the contact surface neglecting the hole is 42x42mm:



$$\sigma = \frac{F}{S} \qquad \sigma = \frac{0.3*9.807}{0.042*0.042} \qquad \sigma = 1667.86Pa = 0.002MPa$$

Restrictions

To carry out the stress analysis, a series of restrictions had to be applied to different faces of the bridge, such as where the bridge is glued with a rotational restriction , which will be glued with screws and the opposite side where the bridge will be supported by the tower. These fixings can be seen in the sections of strains and displacements.

Material Characteristics

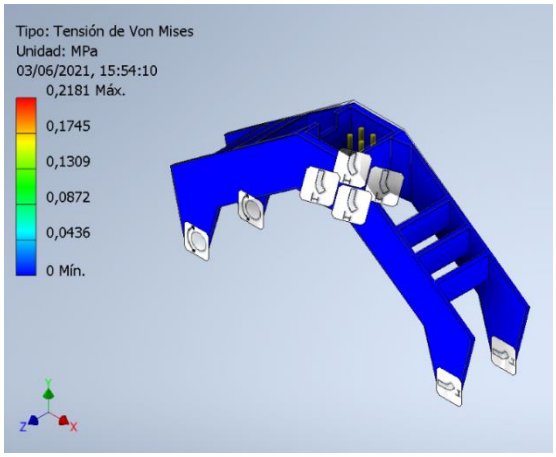
The material used in the structure is PLA, as the parts have been printed with a 3D printer, so to determine the behaviour of the structure towards the pressure applied to its surface, the stresses will be compared with the elastic limit of the material (PLA), to take into account the permanent deformations of the structure and whether it will withstand the applied stress.

The elastic limit of PLA is 55MPa.

Von Misses' Strain

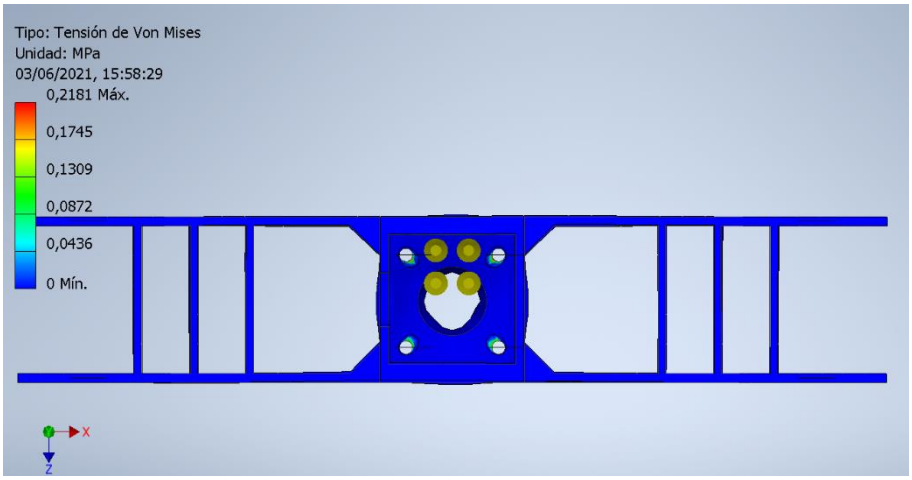
The Von Misses' theory, determine the absolute values of the strains in every point of the solid analysed, to be able to determine the admissible tension in every point of the surface. So, knowing those strains, we'll be able to compare those strains with the elastic limit of the material used in the structure to know if the structure is going to break or being deformed.

So, as you can see in the following images, the strains applied in all of the surface of the bridge is practically 0MPa.



There're just four places where the strains are considerable, where the screws are glued, although the maximum strain is about 0.1745MPa.

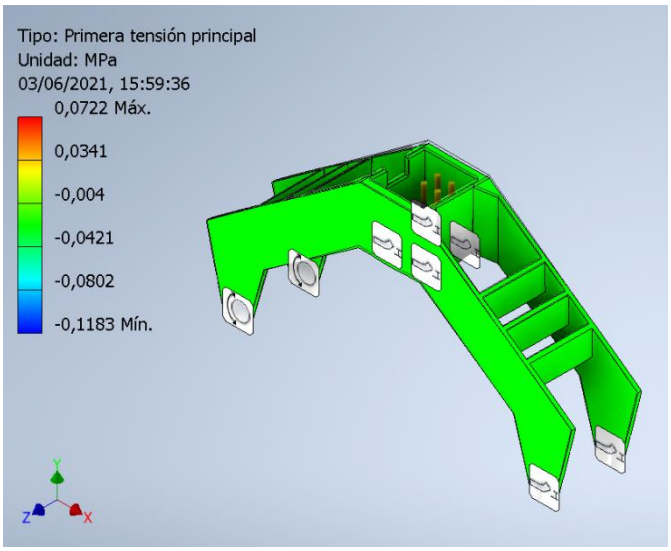
Comparing the maximum strain with the elastic limit of the PLA, the strain will not affect in the behaviour of the component.

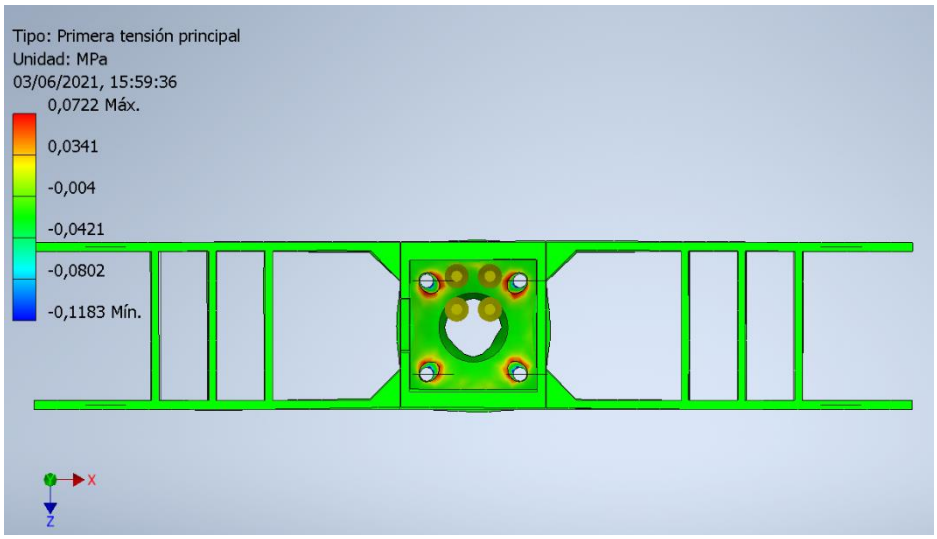


Main Strain 1

Here we can see the maximum strains in the Y axis, which is about -0.0421MPa in the major part of the surface.

The maximum value is about 0.0341MPa and the minimum is about -0.1183MPa, which are situated where the screws are glued.

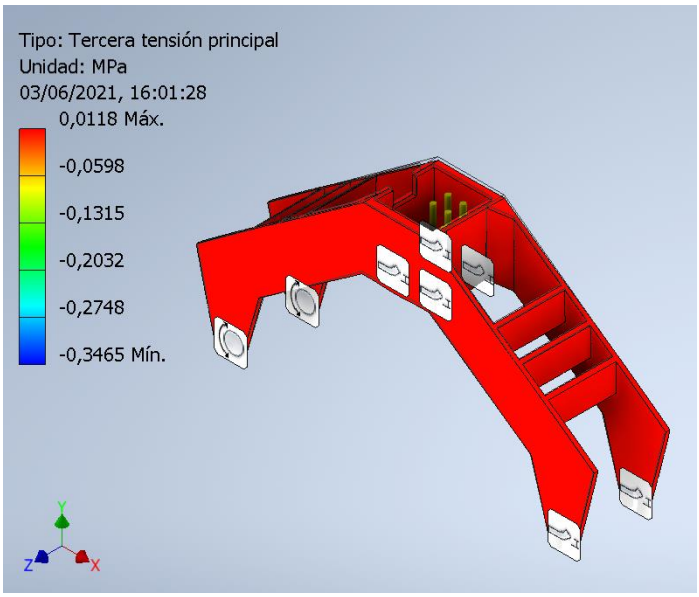


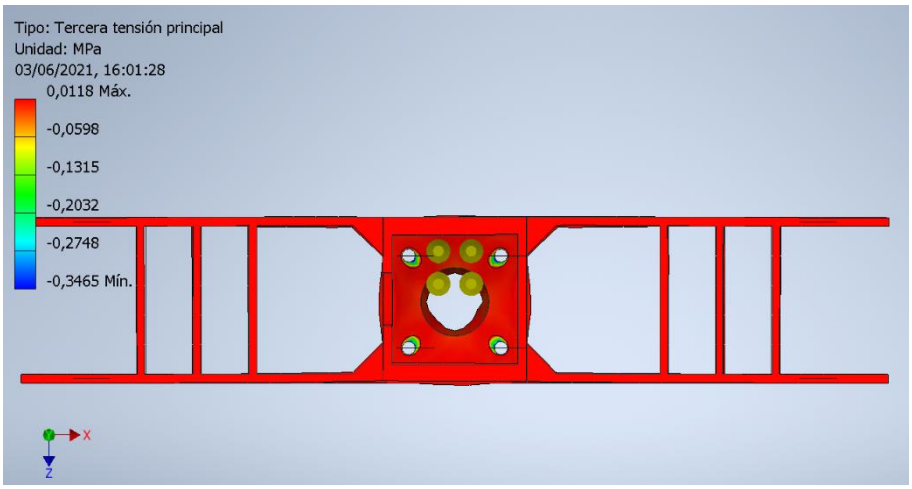


Main Strain 3

Here we can see the maximum strains in the X axis, which is about -0.0598MPa in the major part of the surface, which is the maximum value.

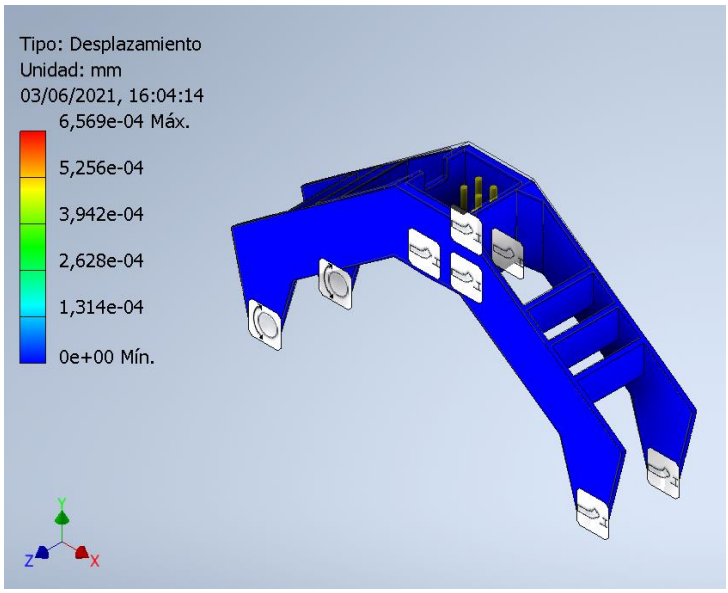
The minimum value is about -0.3465MPa, which is situated where the screws are glued.

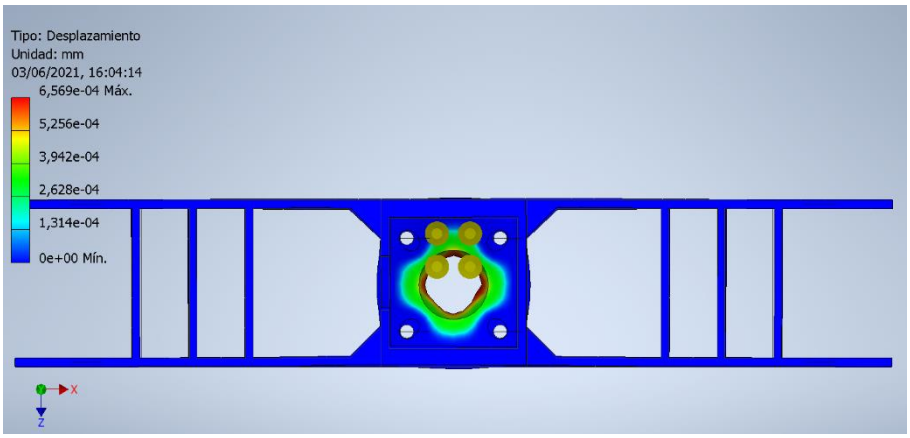




Displacements

As we can see in the following images, there will not be any displacement in the major part of the surface, although in the base where the motor will be situated, there will be some non-important displacements, being the maximum value 5e^-4mm, that comparing each value with the dimensions of the bridge, there will not be any important displacement.





Conclusion

As a final conclusion, we can say that the structure will be able to support the strains produced by the Nema 17 motor, being the most conflictive zone where the screws are glued, although the structure is not going to be deformed or broken. So finally, we can say that the structure easily going to support the 300g of a Nema 17 motor.