4CBLA20 Multiped Robot

Self-Study Assignment
Group 42

SSA No.	Description
4	Designing Wheels/Legs in CAD
SSA Owner	
Pranav Joshi	

Introduction

Since the 3-Legged Design is chosen, its legs/wheels will be designed in this SSA

Goal

To design the 3-Legged Wheel in CAD and combine it with the servo hub.

Conclusion

The wheels were successfully designed and handed to Adomas for further editing (so that the wheel fits properly within the geometric constraints of 30 * 30 * 15)

Continuation SSA's/Recommendations

In the future (perhaps after the preliminary phase), the legs can be redesigned to the shape recommended by Floris in SSA 3 [1], which is slightly different from the shape used in this leg design.

1   Elaboration

1.1   Creating The First Sketch

To start off, the shape of one leg must be replicated onto Siemens NX. Here, the dimensions used by Adomas 1 (while prototyping) in SSA 3 are used. It is important to note that all the dimensions shown in CAD sketch 2 are in **mm** and not in cm
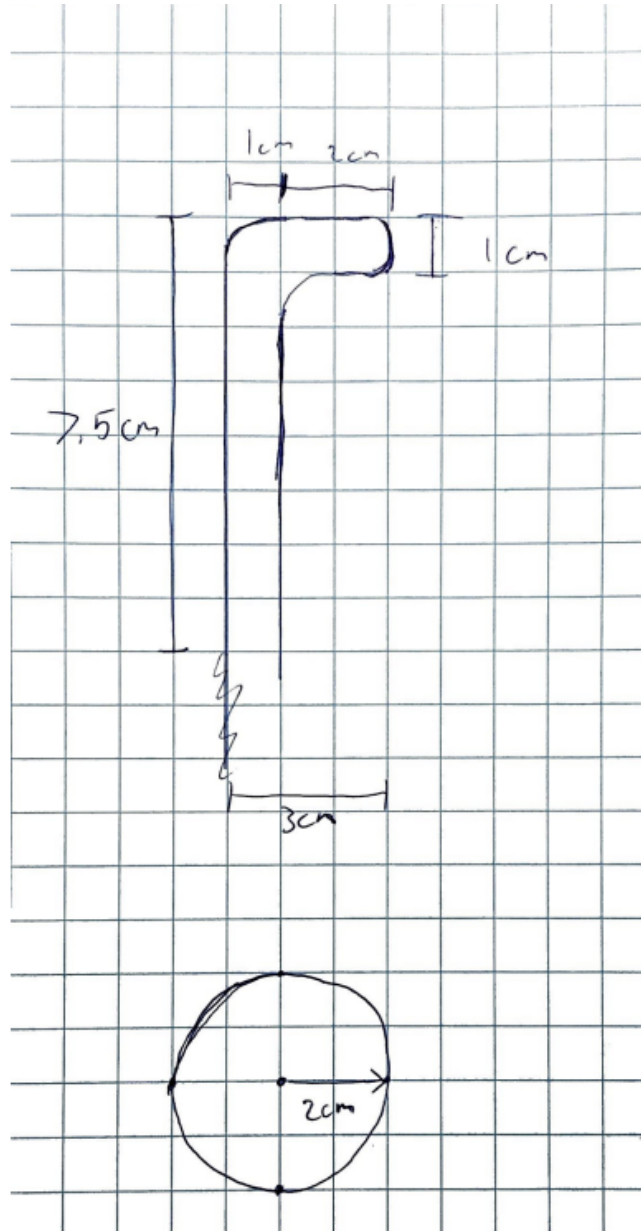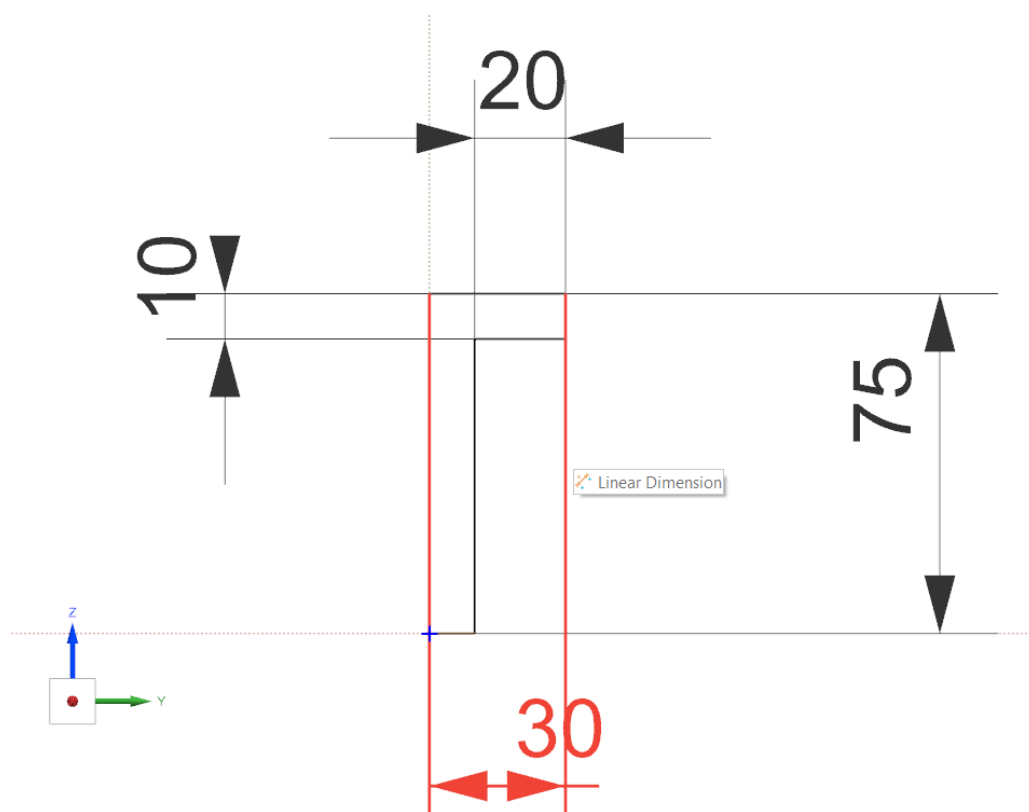

Figure 1: Prototype Dimensions

Figure 2: Initial Sketch

Now, in the above sketch 2, the fillet edges are missing. So, for the next step they were added to the sketch (as seen in fig 3).
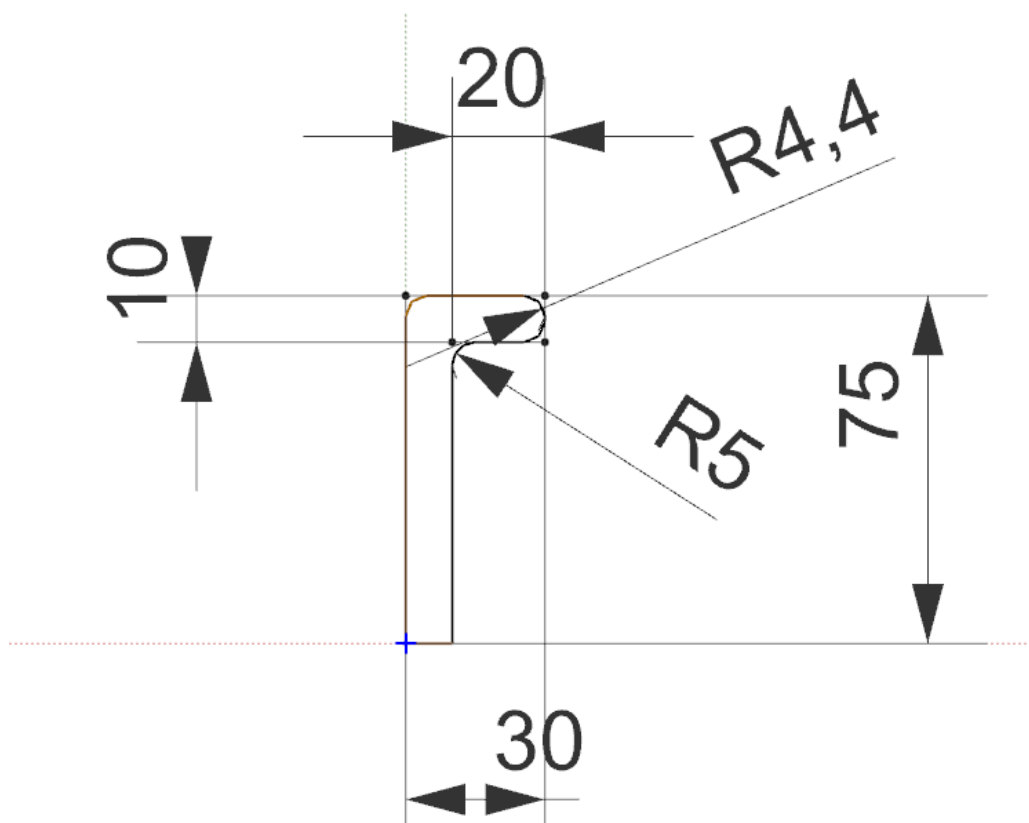

Figure 3: Fillet Edges Addition

Next, the leg was extruded to a thickness of 6 mm as shown in fig.4
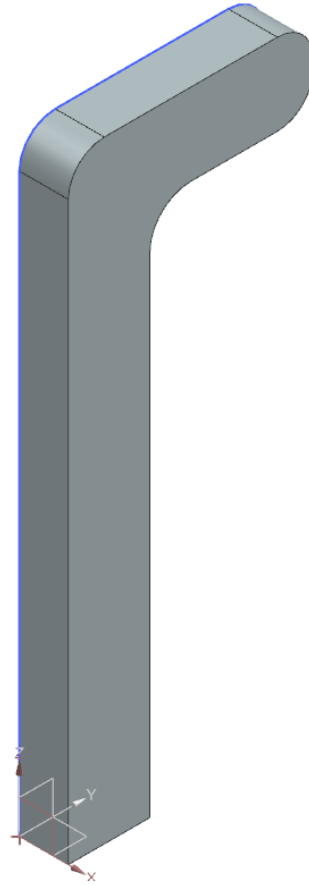

Figure 4: Extruding Leg

With one leg designed properly, to introduce rotational symmetry using this leg as reference, sketches from the servo hub piece need to be imported. This was done as shown in fig. 5
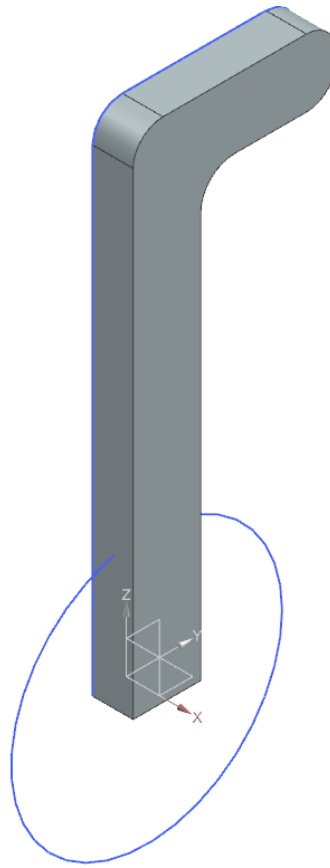
Figure 5: Imported Sketch

After making the base of the leg tangent to the circle, the pattern feature was used to create rotational symmetry as shown in fig. 7
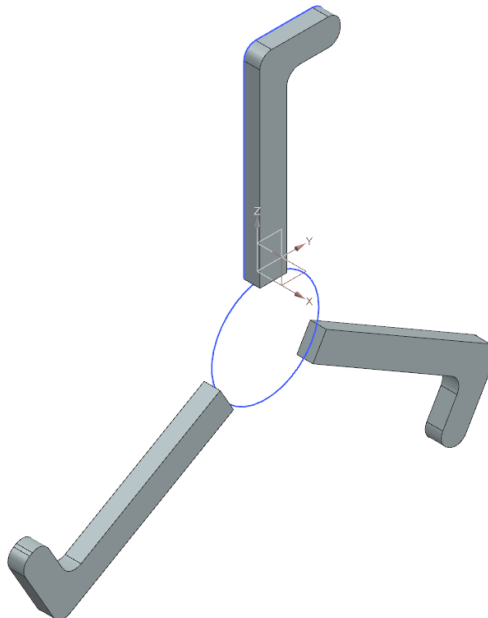

Figure 6: Rotational Pattern

To allow for concentric aligning of the servo hub and wheel legs, the bottom of the legs was made to be a curve of the same radius as shown in figure 7
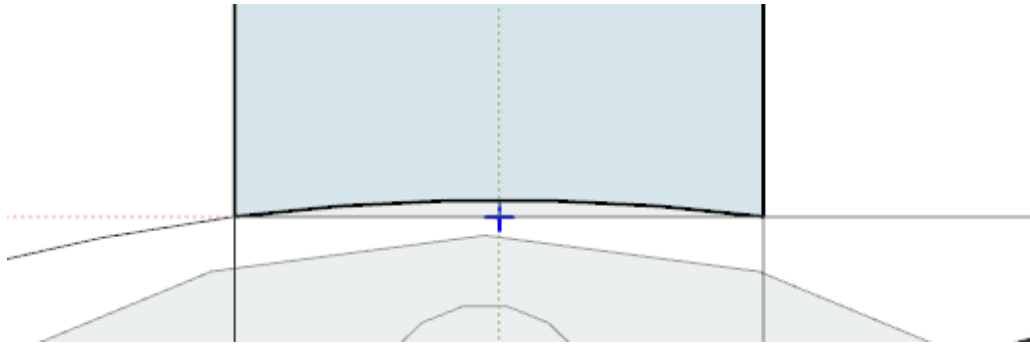
Figure 7: Rounded Face at Bottom

Finally, the servo attachment part file was imported into the assembly and constrained accordingly as shown in fig. 8
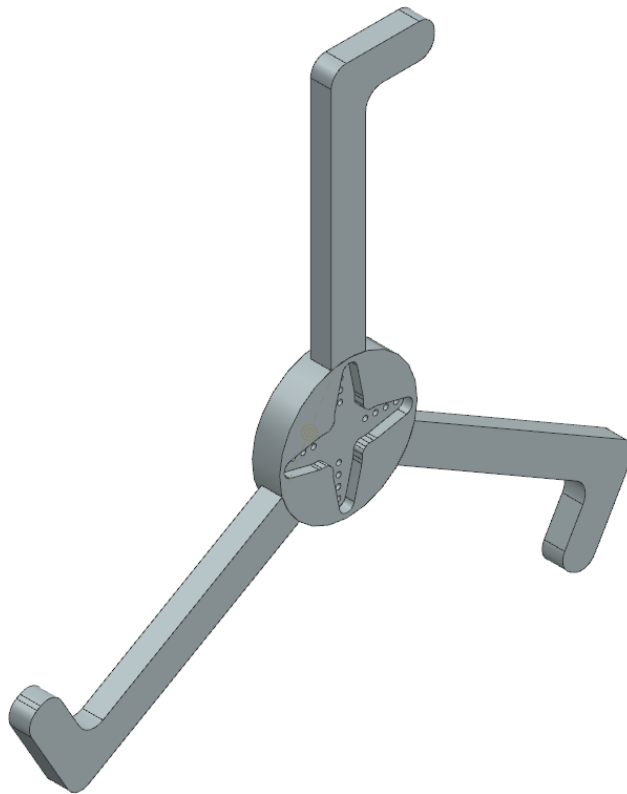

Figure 8: Constrained Design

1.2   Combining to One Part

Using the 2 parts as an assembly could cause problems while plywood cutting/plexiglass cutting, ie; the legs and hub may not be united/attached firmly. Hence, to counteract this, the two parts are combined into one by copying over the sketches, extrusions and pattern maker of the legs to the hub CAD file. After moving around the legs and boolean uniting them with the hub, the resultant part is shown below in fig. 9
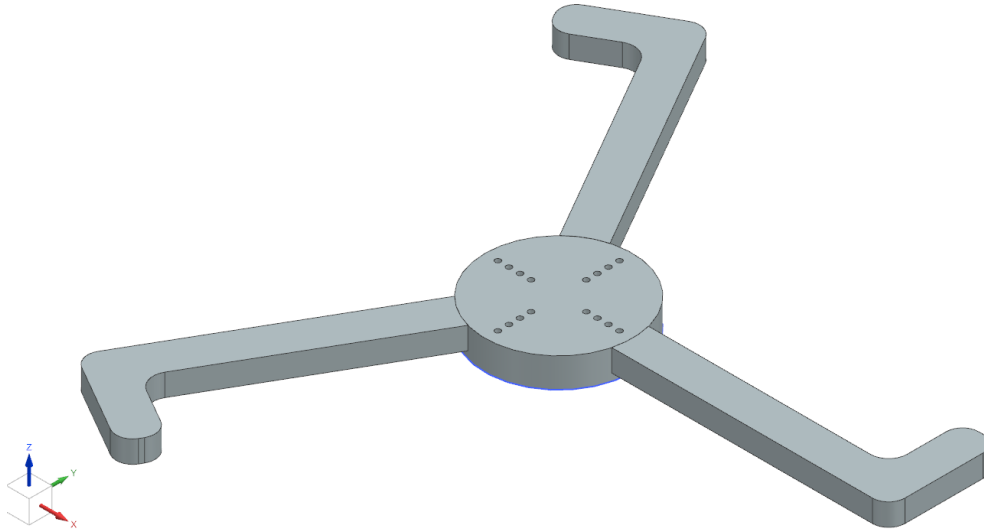
Figure 9: United Part

Now, it will be desirable to have a face blend between the legs and hub to ensure that they are firmly attached and mechanically secure, since most of the bending stresses will be at the point that joins the leg and hub. The face blend feature did not work properly in NX. Hence, a custom support was sketched and revolved near the base of the leg as shown in figures 10 and 11
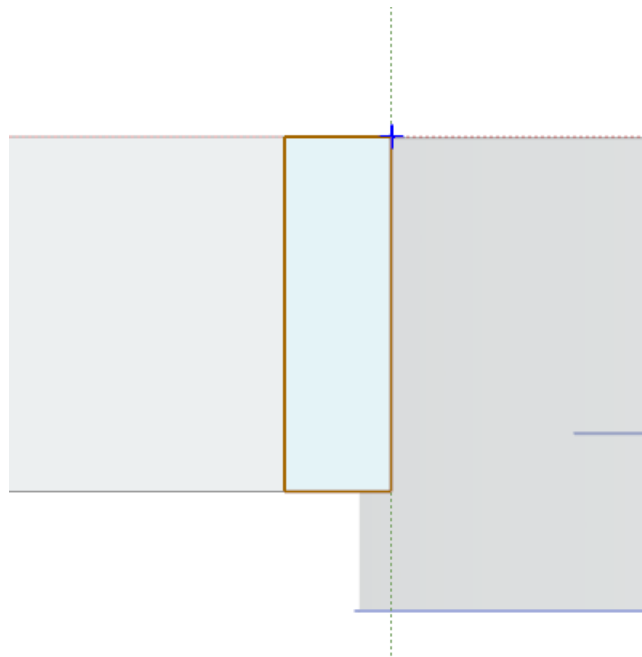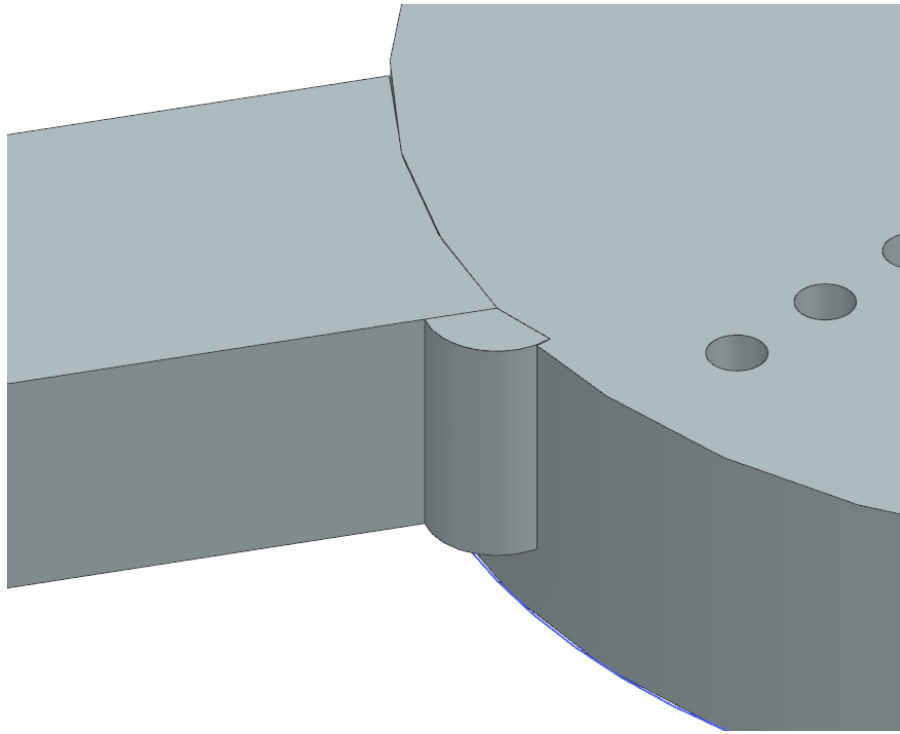

Figure 10: Sketch of support

Figure 11: Completed support

This was mirrored to the other side of the leg. Subsequently, a pair of such supports were added to the remaining 2 legs as shown in fig. 12
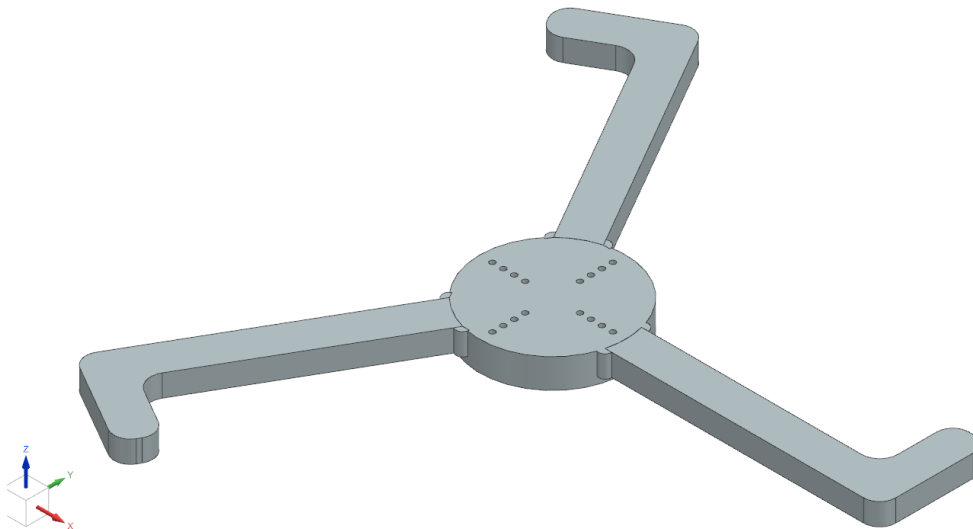

Figure 12: Final Wheel Left Side

Now, the hub was flipped by 180 degrees, a few minor placement adjustments were made and the right side wheel was finished as well, as shown in fig. 13
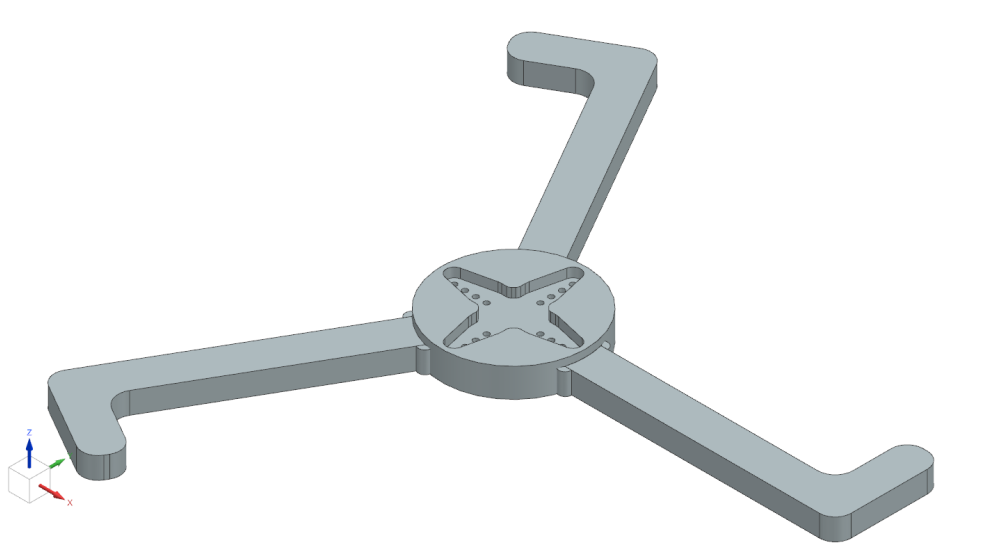
Figure 13: Final Wheel Right Side

Overleaf Link to this SSA

`https://www.overleaf.com/read/fpqkbgqrqyxp#f3faa4`

References

[1] *SSA 3 - Floris van Oosterhout*. URL: `https://www.overleaf.com/3291589373tjsbzqbxznkr#5710ba`. (accessed: 22.02.2024).