Development of a finger for robotic rehabilitation

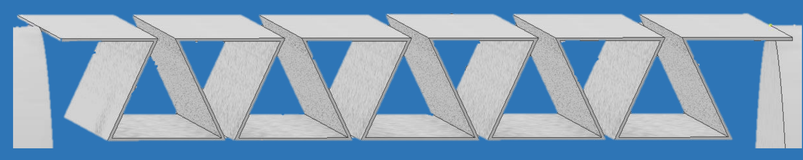
HUGO MEZZATESTA

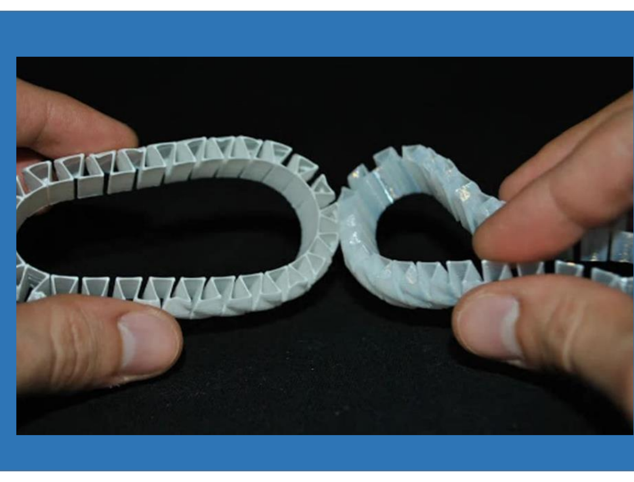
Objective :

The objective is to develop a robotic rehabilitation device using a mechanical engineering approach. This will be achieved by modeling and constructing a finger with advanced 3D technologies. The key steps include researching the latest innovations in the field, designing with specialized 3D modeling software, and Fused Deposition Modeling Techniques (FDMT) techniques for 3D printing compliant material components. Our goal is to be able to flex the finger using air pressure from a compressor.

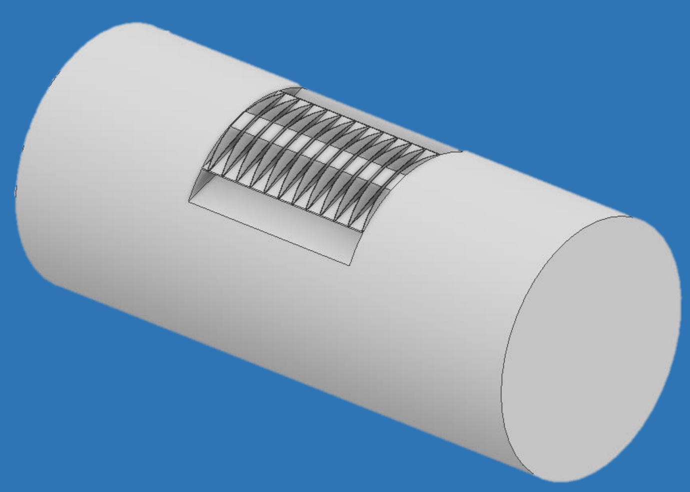
Research :

After conducting significant research, we developed the idea of using triangles to fold our prototype. Therefore, we modelled the triangles on Autodesk Inventor software.

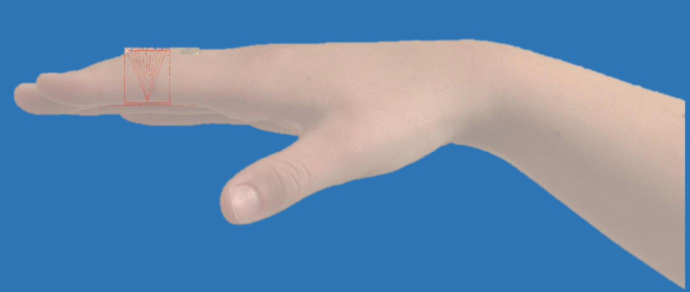


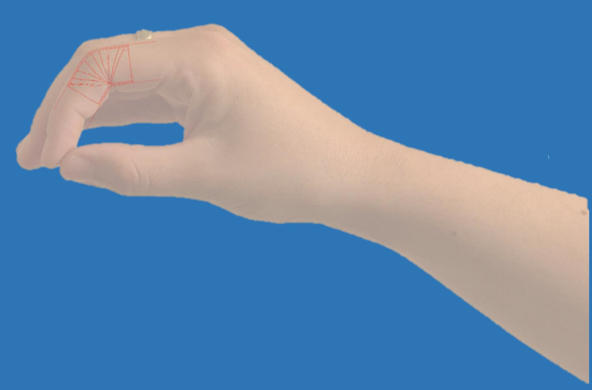


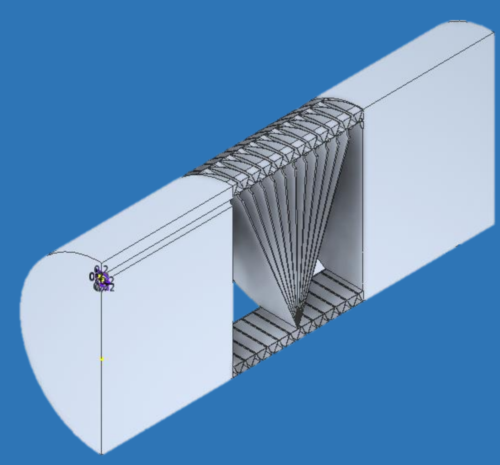
Following this, we began to model our finger to carry out a first test.



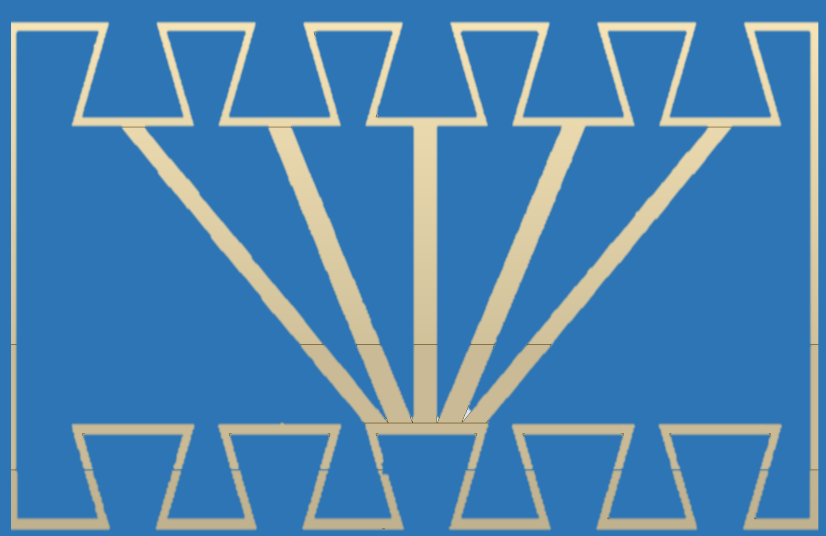
We then considered adding internal sections to allow the finger to bend. Initially, all the sections were connected at a single point. However, it was concluded that this approach made 3D printing impractical.

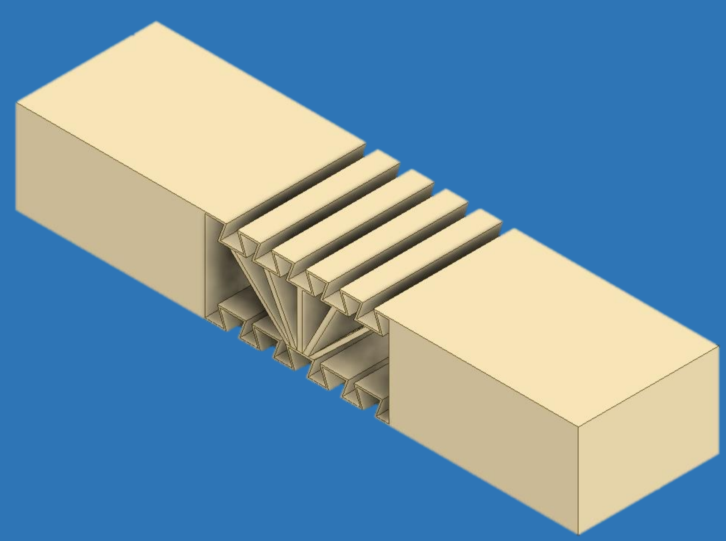


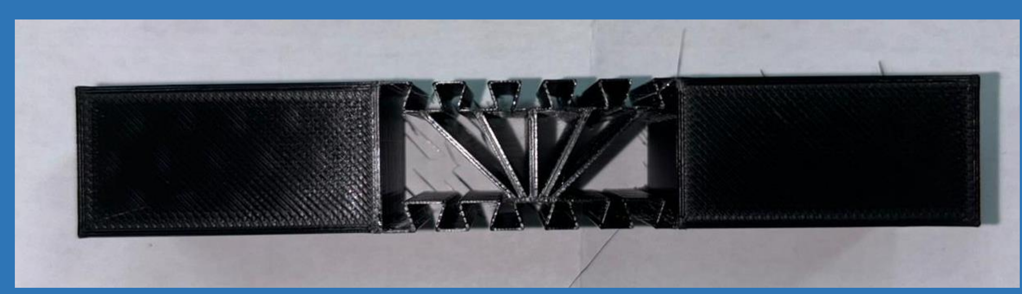


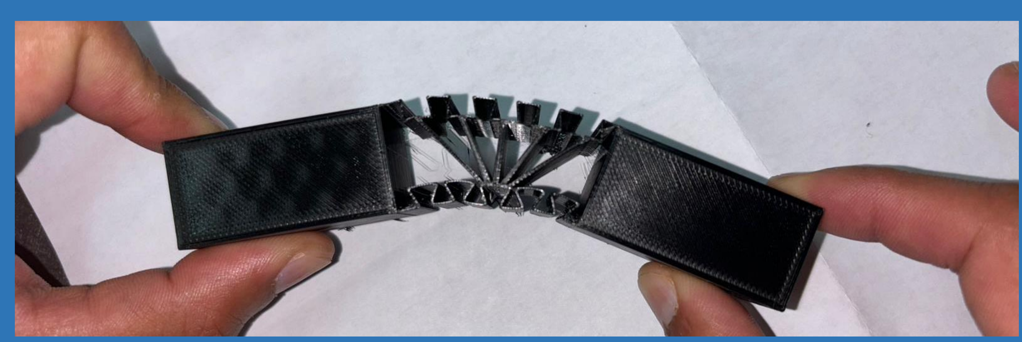


After modeling the internal sections in such a way that they did not join at a single point, we proceeded with our first full-scale 3D print using a rectangular-shaped finger. This print failed due to the excessive thinness of the internal sections and the triangles. Therefore, we made a new print, doubling the scale, which produced a satisfactory result.

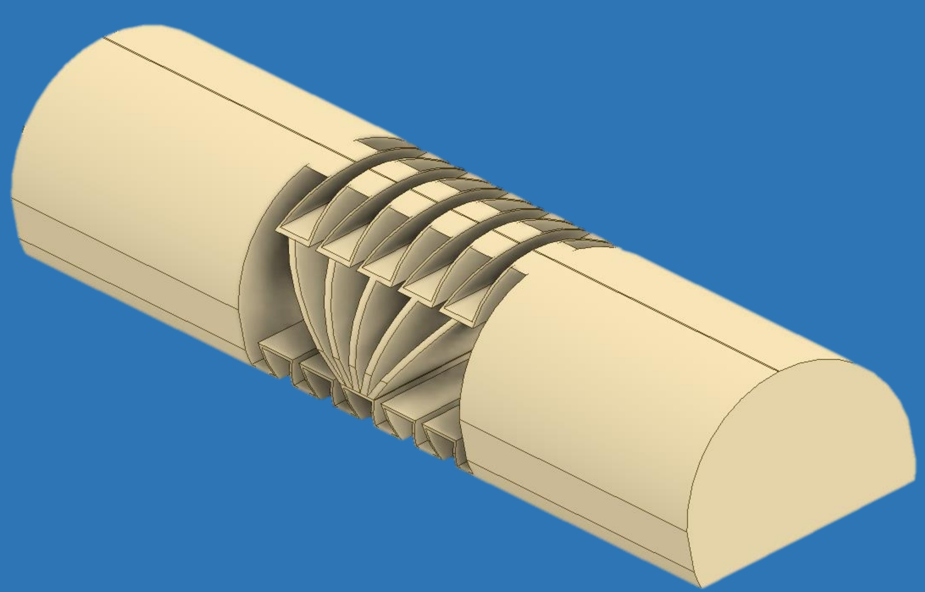


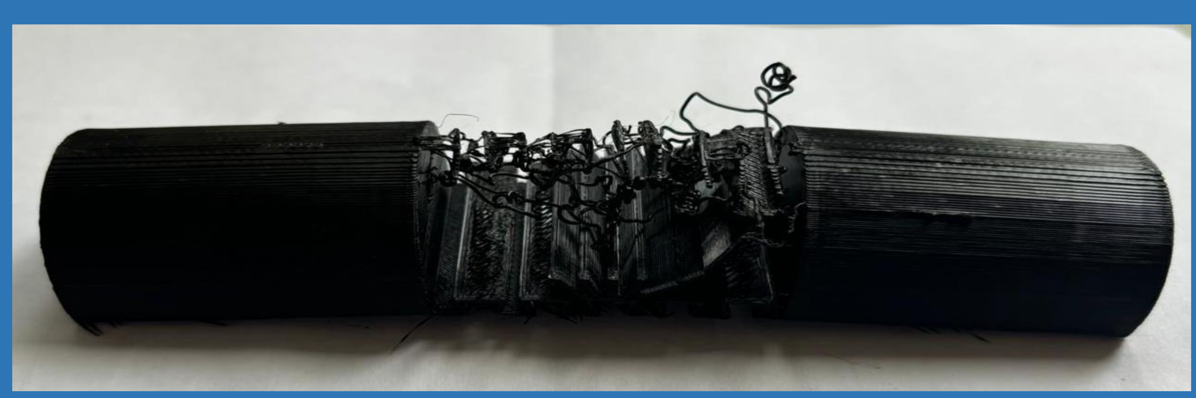


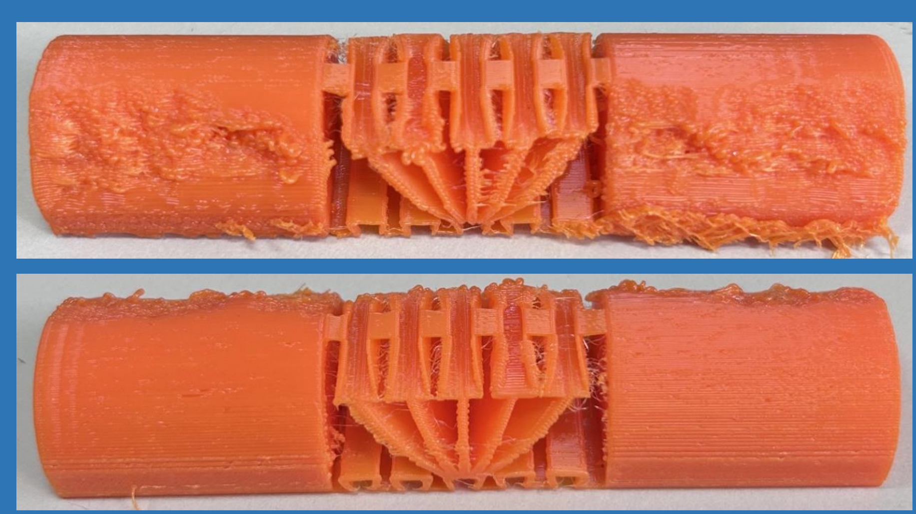




We remodeled the finger, giving it a rounded shape. However, due to poor print settings, the finger was not printed as expected. We then proceeded with another print using a more flexible filament. Although there was a printing defect on one side, the result was acceptable







Currently, the finger cannot bend under air pressure due to air escaping through the open sections of the model. As a result, we will explore several solutions to this constraint.

We are currently working on improving our prototypes to develop a solution incorporating an air chamber to enable the finger's flexion.

Conclusion:

In conclusion, we have produced several prototypes of different shapes, but improvements in the modeling process are still needed. We are specifically working on incorporating an air chamber to enable the finger's flexion. Ideally, having two extruders on the 3D printer would allow us to simultaneously create part of the finger with TPU (flexible filament) and another with PLA (rigid filament).