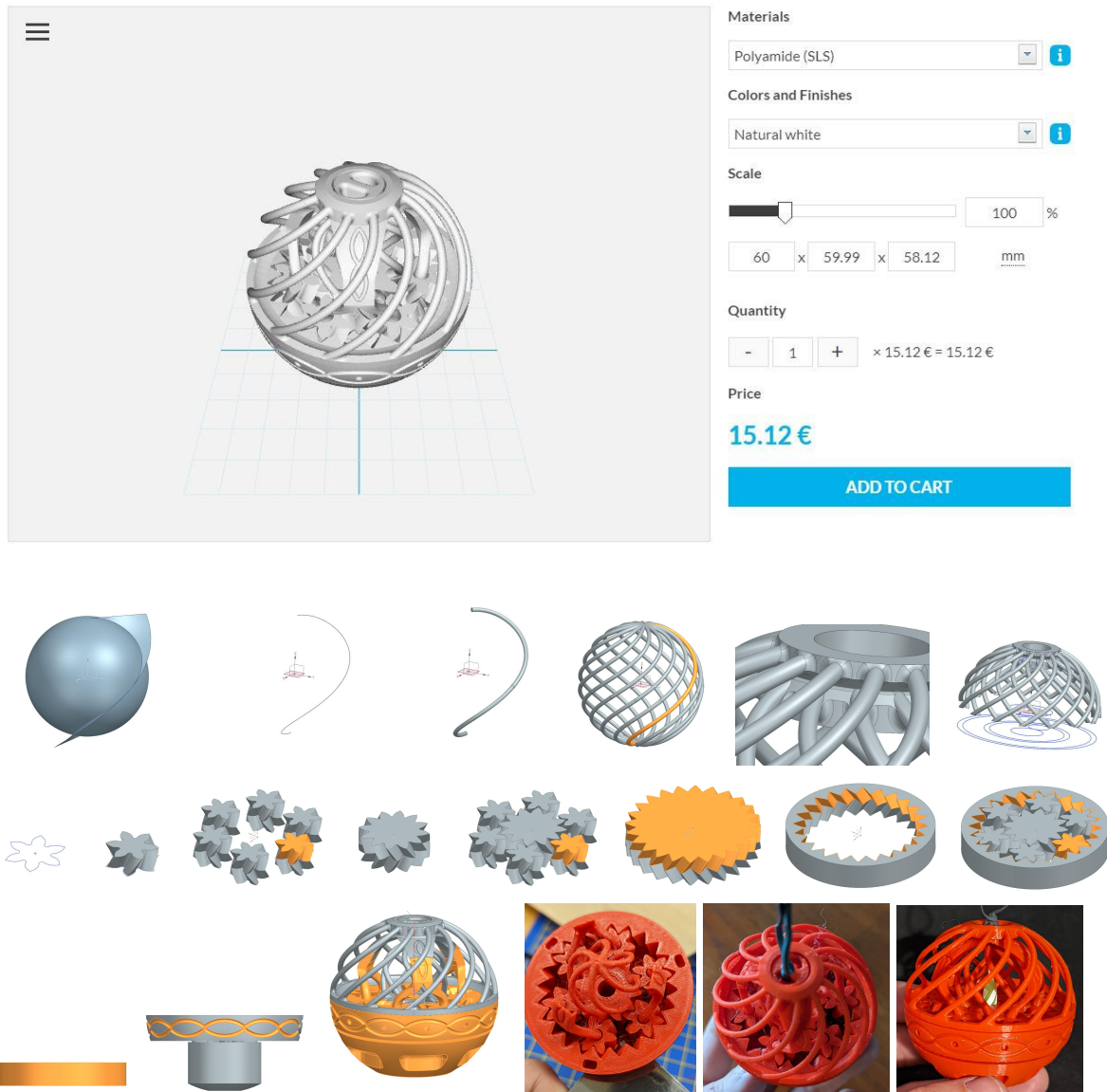


## Assignment One Report

### General Overview / Appendix



### Timelines

- Modelling: ~40 hours of design and iteration in NX
- Print Setup: 30 minutes per print
- Print time: 8-12 Hours per FDM print (4 prints)
- Post processing ~2 hours per print (x4)
- Total working time: ~ 50 hours
- Total Machine time: ~40 hours

## FDM Design Challenges

### Tolerancing

Due to the physical limitations of the printers' precision and the geometric constraints of the slicing software and path, certain dimensions had to be given increased clearances; namely the gears. This was the source of much of the iterations between prints, trying to find the balance between having the gears falling out despite them being interlocking, or having them fuse together and be impossible to turn. The eventual tolerance range was approximately a 0.2mm minimum distance between gears.

### Print Setup

While most settings were simply left to default, there were a few notable changes to the print setup. First, the shell layers were increased to 3 from the standard 2; this was done to give additional strength to the thin columns making up the inner and outer cages, which were extremely brittle with only two shells. Second, support material was applied manually, exactly up to the layer on which the gears were printed, with the main body of the ornament in a right side up orientation. Also, custom support placement was used to print the other parts on the same bed, despite them requiring full support.

### Design considerations

After the first round of printing and post-processing, much of the ornament and its mechanisms were redesigned to require less support material. The key change here was reconstructing all of the parts to print in an interlocking fashion, but breaking two of the components into separate parts, so that the parts that required support could be printed separately and snapped into place. The first of those parts is the outer cage, which is shown in grey on the last CAD image and wedges into the three holes shown in the partially assembled ornament, third to last. The other part was the main support structure, which is printed in two parts and snaps together to hold the ornament up, though (by design) the seams are fairly hard to notice.

## FDM Post Processing

### "External" support material

The "external" support material was necessary for the printing of the snap-on parts, which were the outer cage and upper support piece. This was fairly standard removal, if somewhat fragile due to the thin elements of the outer cage.

### "Internal" support material

The internal support material was generated beneath and between the gears, and between two internal surfaces directly below the gears. In the third to last image of the ornament, you can see a scraper visible between the gap in two gears. This also shows some of the support material there, which is quite difficult to remove and located in a fragile area, as any misplaced force could snap the stems that the gears encircle, ruining the part.