ReMold

Shaping Sustainable Composite Manufacturing

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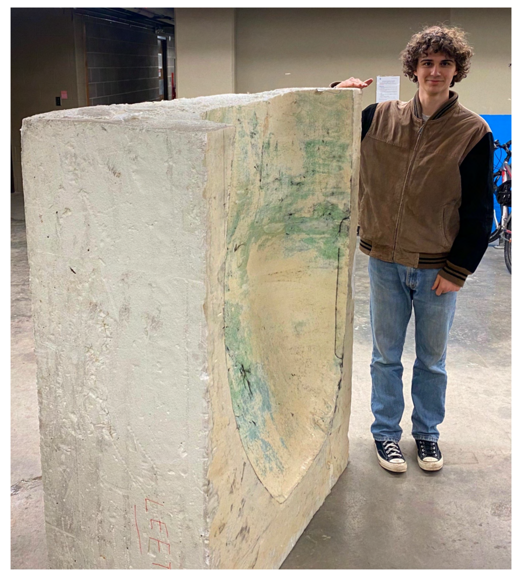
CAD file uploaded → Mold surface created

Problem



Machining molds of curved geometry for composite parts is wasteful, costly, and time consuming.

- 4-8+ weeks to manufacture
- Hundreds of dollars per hour
- Severe environmental impact; molds discarded after single use

Goal

To create a device that enables low-waste, rapid, and cost-effective prototyping of complex shapes in composite materials through a fully adaptable molding surface.

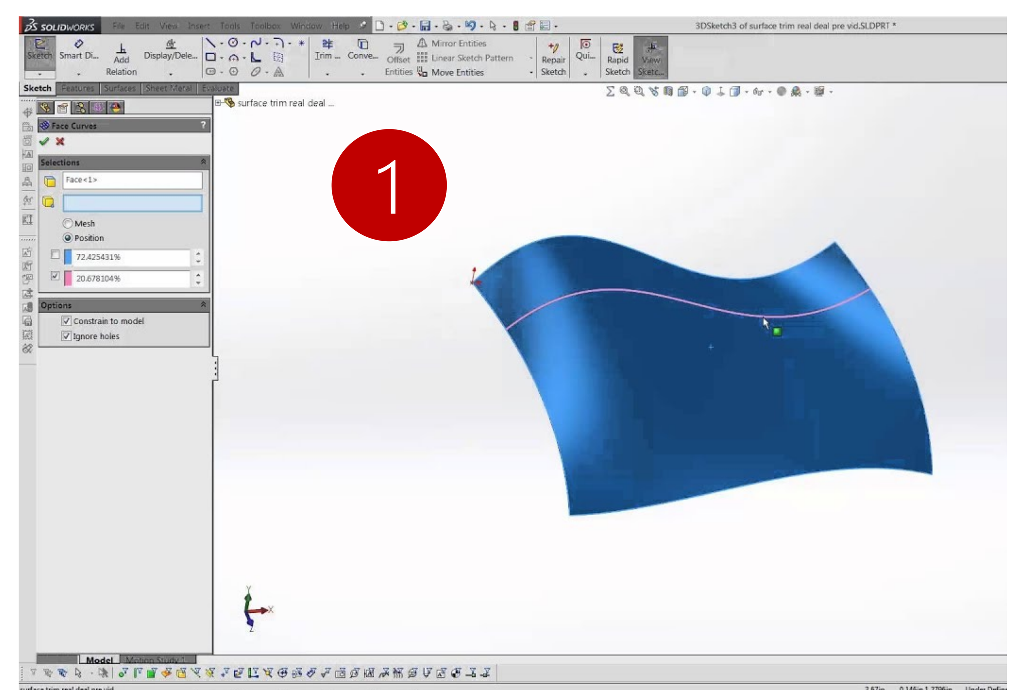
Stakeholders

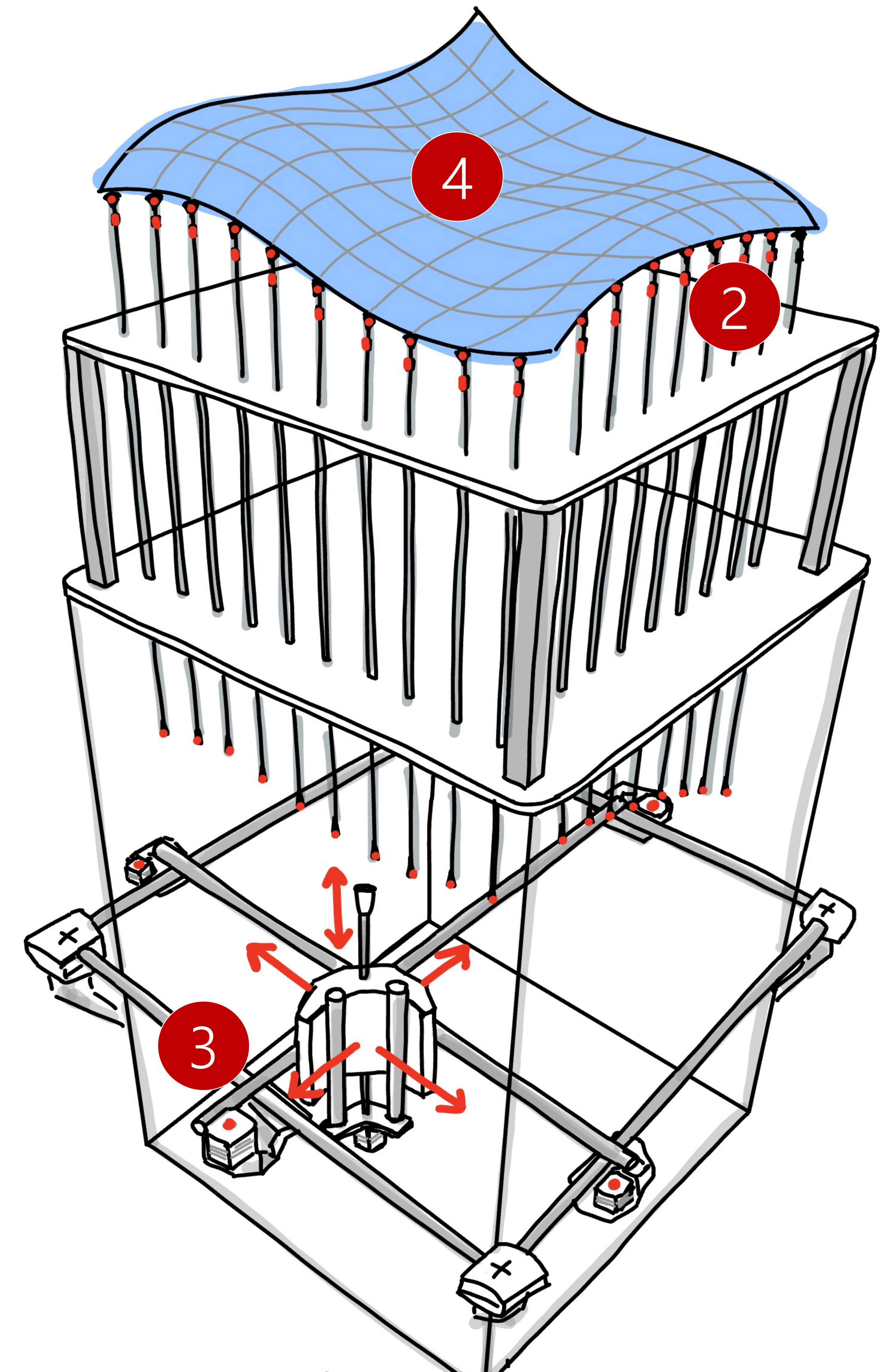
Adanac Patterns

With the generous support from the AMS Sustainability Project Fund

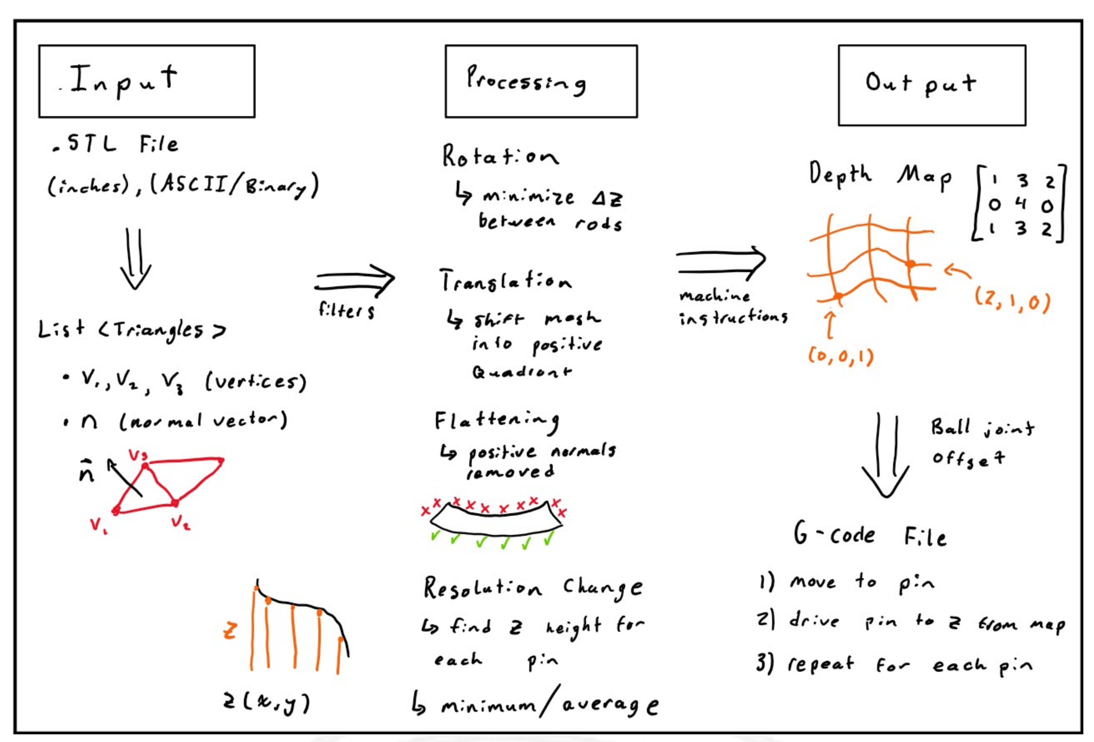
Future Work

- Produce more complex composite parts
- Surface accuracy validation through Digital Image Correlation (DIC) or Coordinate Measuring Machine (CMM)



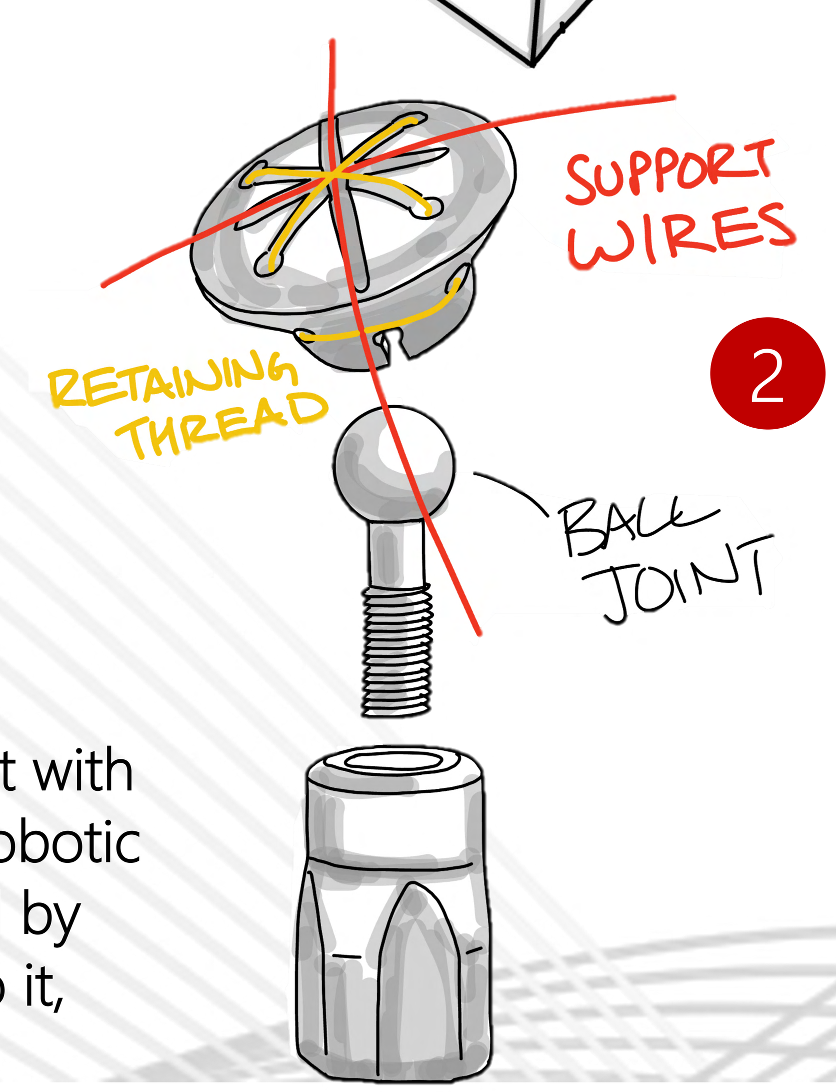


1 Software/Firmware



2 Pinheads

Each point given by the 3D model is represented by the top of a threaded rod. Each rod has a swiveling head to support the top surface at whatever angle is required. Each swiveling head supports two wires which help add structure to the mold shape.



3 Pin Actuation

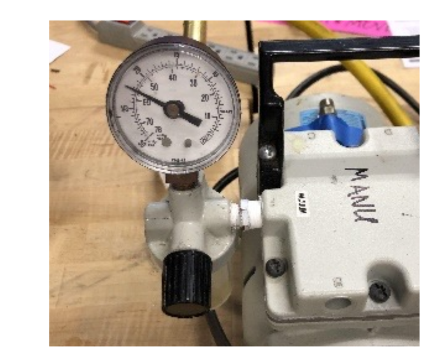
Each pin is brought to its desired position by rotating it with a stepper motor. This stepper motor is attached to a robotic gantry which moves below the pin array. As controlled by the software, the gantry moves to each pin, locks onto it, and rotates it to its desired position.

4 Top Surface

The top surface, which takes the shape of the pins and supports the composite part, is made of a mesh of support wires topped with a layer of high-temperature silicone rubber. The advantages of this compound top surface are as follows:

- Wires help smooth out curvature and support between pins
- Soft silicone forms to the shape of the surface beneath it
- Can withstand temperatures up to 260°C
- Easy to demold part
- Affordable, reusable, and replaceable

One way we tested different materials was to apply vacuum pressure to a miniature surface of pins to see how the material would deform. Samples of natural rubber, EPDM, polyurethane, and softer silicone were tested. Tensile tests and heat tests were also performed to validate stiffness and temperature compatibility.



Vacuum Chamber

Vacuum pressure is applied to evenly distribute the top membrane across the entire surface.

To achieve this, a steel vacuum chamber was built. The pin head and alignment plate array is placed inside the chamber on adjustable inserts, to roughly align the pin array with the top of the box. The top membrane is clamped to the top of the vacuum box such that when vacuum is pulled through a port on the side, the membrane will be pulled down upon the pin heads, assuming their shape. The vacuum chamber is then placed inside an oven to cure.

Most industrial composite ovens have vacuum pumps that route inside which makes the use of the vacuum chamber simple.