**Steps to print Delaunay lofts using multiple printers:**

1. Run ***delaunayLoftPrint.py***, which will prompt you to select the text files for each robot (select txt file for robot1 first(Now its name is QQQ\_R1), followed by the one for robot 2(Now its name is QQQ\_R2)). **Note:** **If this is the first time you are using python, you will have to download python first, followed by several python packages. Please contact me and we can setup a meeting where I can help you download python and all the associated packages.**
2. I have attached sample txt files for both robot1 and robot2.
3. Once you run ***delaunayLoftPrint.py***, it will output the gcode files for both robots in the same folder. Each gcode file can be identified easily as they have prefixes (AMBOT1\_XXX and AMBOT2\_XXXX) for identification.
4. There is a visualization.py file that one can use to visualize how the polygons might look like in terms of alignment. However, it is somewhat buggy and assumes that the robots are perfectly aligned. This visualization file reads txt files and draws the polygon in turtle environment in Python.
5. You should use a slicer to double check if it is what you want to print.(e.g., pursa, cura)
6. Upload the g-code file to the UI(QQQ\_R1 to printer 1 and QQQ\_R2 to printer 2)
7. Before you start the printing, you need to do the bed leveling calibration for two printers. Check in the UI dashboard to see if it is mesh. Also, you might need to adjust the baby stepping in the status window.
8. Start one of the printers to print the first loop of the first layer and pause.(**Caution:** When you pause the printer, I don’t know if the new printer would maintain the temperature240℃. Check again when you restart.) Then start the other printer and pause after the same sequence. This step is to locate the start point of each printer and the boundary gap between each printer.(If the layer is printing inside out then you need to print the first layer to see if they can attach parallel. This depends on different tests. )
9. The first time, the polygons are likely going to be far apart. If that happens, you will have to add or subtract numbers to (line **39** and line **40**) the current values (e.g., x\_new = x + 5.0) to get a more accurate location for the polygons. So, you could change it to x\_new = x+10.0 or something like this to move it in x direction and y\_new = y + 10 or something similar to move it in y-direction. These two lines modify position of polygons printed by robot 2.
10. In conjunction with this, you could also modify lines **65** and **66** in the manner similar to outlined in step 5 (these two lines control the location of print for robot 1). If this one does not work, you can play around with these four lines to get the right location.
11. If the two boundaries are parallel, please continue to step 12.

If the two boundaries cross each other and **cannot** be completely coincident, then you probably need to perform a manual XY calibration on one or both of the printers. This function is available in AMBOTS APP, it cannot be controlled on the UI from the browser, what you need to do is to open the AMBOTS APP, click the created floor, after connecting to the printer, click Calibration. The process will first complete the bed leveling calibration, and when completed, a window will pop up in the UI from browser for you to move the print head to the four corners accurately. After you finish the calibration, open the console in the UI, check the value in the calibration feedback information. This value should be as smaller as it can be(Normally under 0.5 or 0.3). You can try to print a new loop to see if the shape is twisty to check and then print the other boundary to check if they can match. If the problem still exists, unfortunately you have to redo the calibration again.

1. At this point, you still have on last step to be ready to start the test. Check the diameter of your filament, linewidth and layer height(line 284 to line 286) to make sure it’s the same setting in the UI. (When you encounter some extra extrusion or under extrusion. You can adjust the linewidth in the code and also in the UI.)
2. Set up the camera to record the test.
3. Now you can restart printer 1 and start to print the first part. Make sure that printer 2 maintain its temperature at 240℃ and ready to go. Start the printer 2 after printer 1 printed certain number of quads(depends on different tests). Note: there are some distance between print head and the printing start point. You might want to pre-start a little bit.
4. If the printers collide to each other, press the Emergency stop button or stop the print task on UI. Redo from step 7 if the collision is serious.
5. If the nozzle collides to the printing product, adjust following step 12. Pause it when this happens. Home the nozzle again(click the home button in UI). If the product is in the way, temporarily replace the product and acrylic build plate to a clear one. Clean the collide position and continue the printing.