

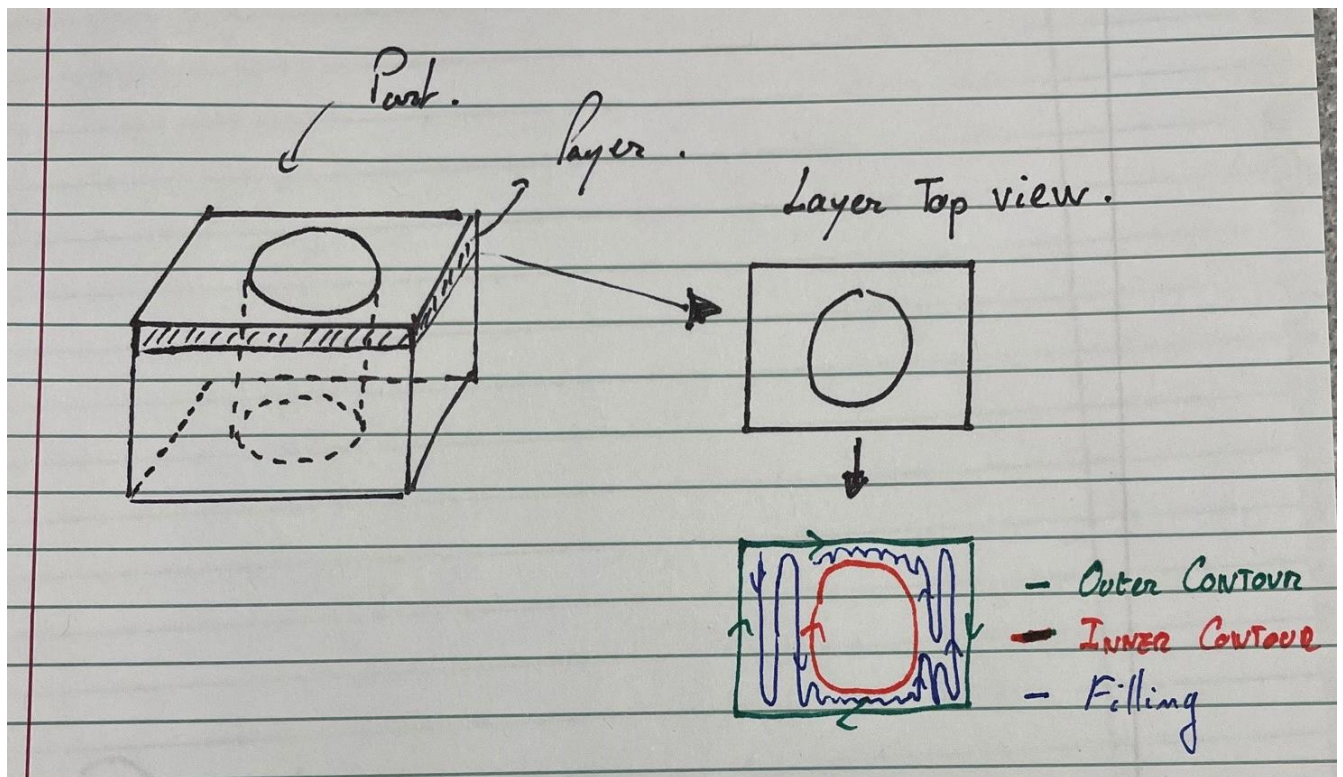
### Work proposal:

Develop a Python module that slices a geometry into contiguous segments, starting by the outer perimeter of the part and then filling the inside. This Slicer module outputs tuples of tuple of coordinates  $((x_0, x_1, x_2, x_3 \dots), (y_0, y_1, y_2, y_3 \dots))$  defining contiguous segments  $S_1 = ((x_1, y_1), (x_2, y_2))$  and  $S_2 = ((x_2, y_2), (x_3, y_3))$  up to the  $n$ -th segment  $S_n = ((x_n, y_n))$ . Each segment has a thickness defined by the parameter  $T$  (in mm).

### Description of the work:

We want to generate a custom slicing tool path at each layer of the geometry provided – see **Figure 1**. The toolpath should follow the following steps:

1. **Contouring step 1:** First, contouring the outer perimeter of the part (example in green)
2. **Contouring step 2:** If there are cavities in the part, contour the inner perimeters (example in Red)
3. **Travelling inside the contours step:** Finally, travel inside the inner and outer contours without stepping over the previously extruded material (in blue)



**Figure 1:** (a) hand drawing of the different travels: The part in black (top left) is sliced in layers (top right) and we want a tool path that does 1<sup>st</sup> green outer contour, 2<sup>nd</sup> red inner contour and 3<sup>rd</sup> blue filling

### Code requirements:

Design a slicer function in Python. The function takes as input a 3D shape in .stl or .step format and outputs a tuple of coordinates  $((x_0, x_1, x_2, x_3 \dots), (y_0, y_1, y_2, y_3 \dots))$  representing the path the machine should follow to contour the perimeter of the part and fill the inside of the contour.

We had previous success using Shapely ([The Shapely User Manual — Shapely 1.7.1 documentation](#)), but you are free to use other libraries.

**Input** – `geom_filename` (str) path to the 3D Shape with .stl or .step format

`settings` (dict) slicer parameters:

`infill_origin_xy` (tuple) (x, y) origin position from where the first segment starts

`path_fill_width` (float) width of a segment (typically 1-3mm)

**Output** – `contour_segments` (tuple) ((x0, x1, x2..., xn), (y0, y1, y2... yn)) where n is the number of segments to perform the full outer and inner contour of the part, (x0, y0) is the infill origin and any (xi, yi), (xi+1, yi+1) is the i-th contiguous segment of the tool path

`filling_segments` (tuple) ((xk, xk+1, xk+2..., ), (yk, yk+1, yk+2... )) segments to fill the part, not going over the previously extruded contour at this layer