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AUTOMATIC PART POSITIONING FOR PRECISE XY RENDERING

HP INC

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Title

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Abstract

During the process of converting a 3mf to ink drops several discretization/renderings are done. In each step some information is lost. In the present disclosure an automatic way to orient parts inside jobs in order to minimize the lost information in the one of the lasts rendering steps is described. Is in this step where the slice (a slice is the result of discretize the part in the Z axis), that is a 2D image, is discretized to pens resolution. In the Figure 1 these steps are represented:

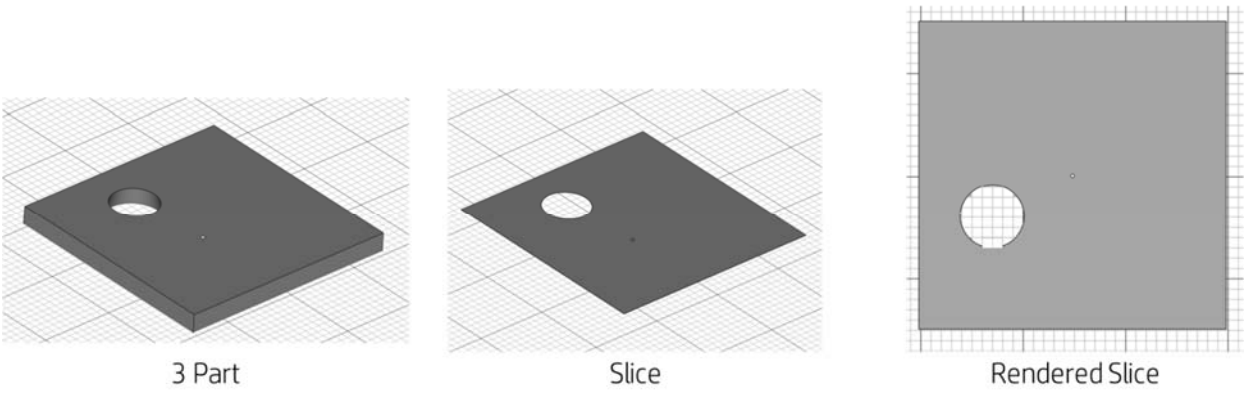

Figure 1: From a STL to a rendered BKZ

When rendering at printing resolution the sliced part needs to be fed into the matrix. If lines are not completely parallel to the rendering matrix then some information is lost. In the Figure 2 the difference of rendering a parallel rectangle vs a tilt can be observed

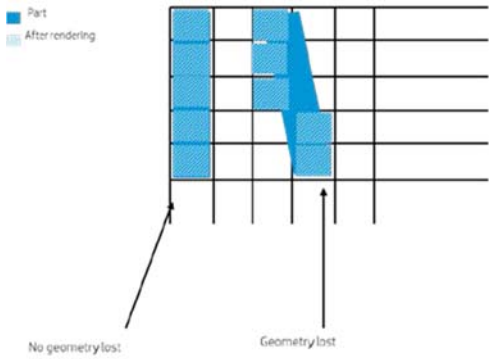

Figure 2: Difference between rendering a rectangle parallel to printing axes (left) vs one tilt (right)

This information loss can be appreciated in the final printed part (see Figure 3):

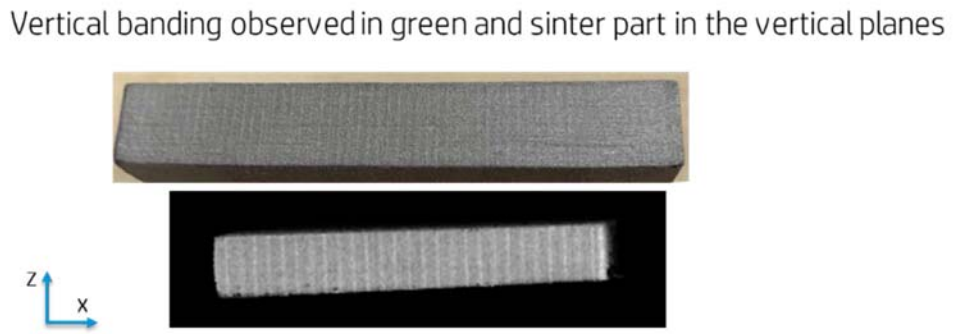

Figure 3: Metals sintered part where rendering resolution can be seen

In simple geometries, like a cube, an expert user can use their experience but for complex geometries there is a need of an automatic to do it (see Figure 4).

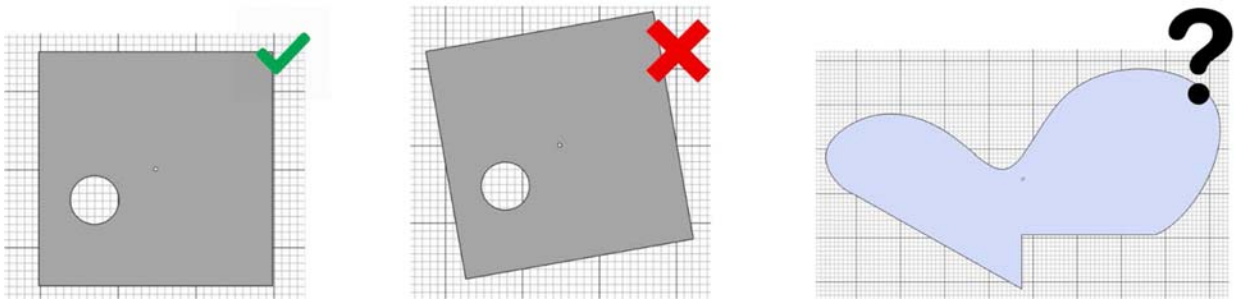

Figure 4: An example where user can identify how to orient for precise rendering (left and middle) and one not

In the present disclosure an automatic way to orient the part to avoid vertical banding and minimize the loss of dimensional accuracy is presented.

New solution description

As it can be seen in the Figure 2 the challenge is to place the surface exactly in the parallel to the vertical or the horizontal axis, if that's not possible it should be close as possible but avoiding small angles to prevent look and feel defects (see Figure 6)

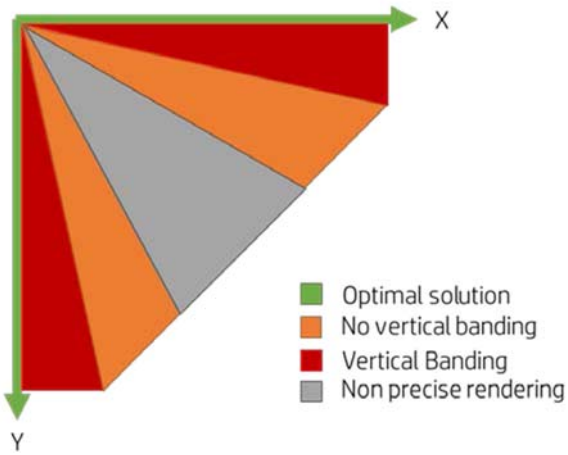

Figure 5: Surface orientation vs render accuracy and vertical banding defects

Every 3D printed part is made by triangles, this algorithm search for every triangle outer normal and compare them with the Z plane normal, using the values seen in the Figure 6 we can differentiate four types of triangles:

- Optimal: These will be perfectly rendered and won't suffer vertical banding
- Vertical Banding: Good rendering but Banding defect clearly seen
- No vertical banding: No vertical banding observed but not perfect rendering
- Non-precise rendering: As the planes are render really far away from the axis where the rendering error is higher

This algorithm tries based on iterations place most of the planes in the optimal solution area and in the no vertical banding area avoiding red area.

In the following workflow can be seen how the algorithm will perform to minimize rendering losses as well as vertical banding:

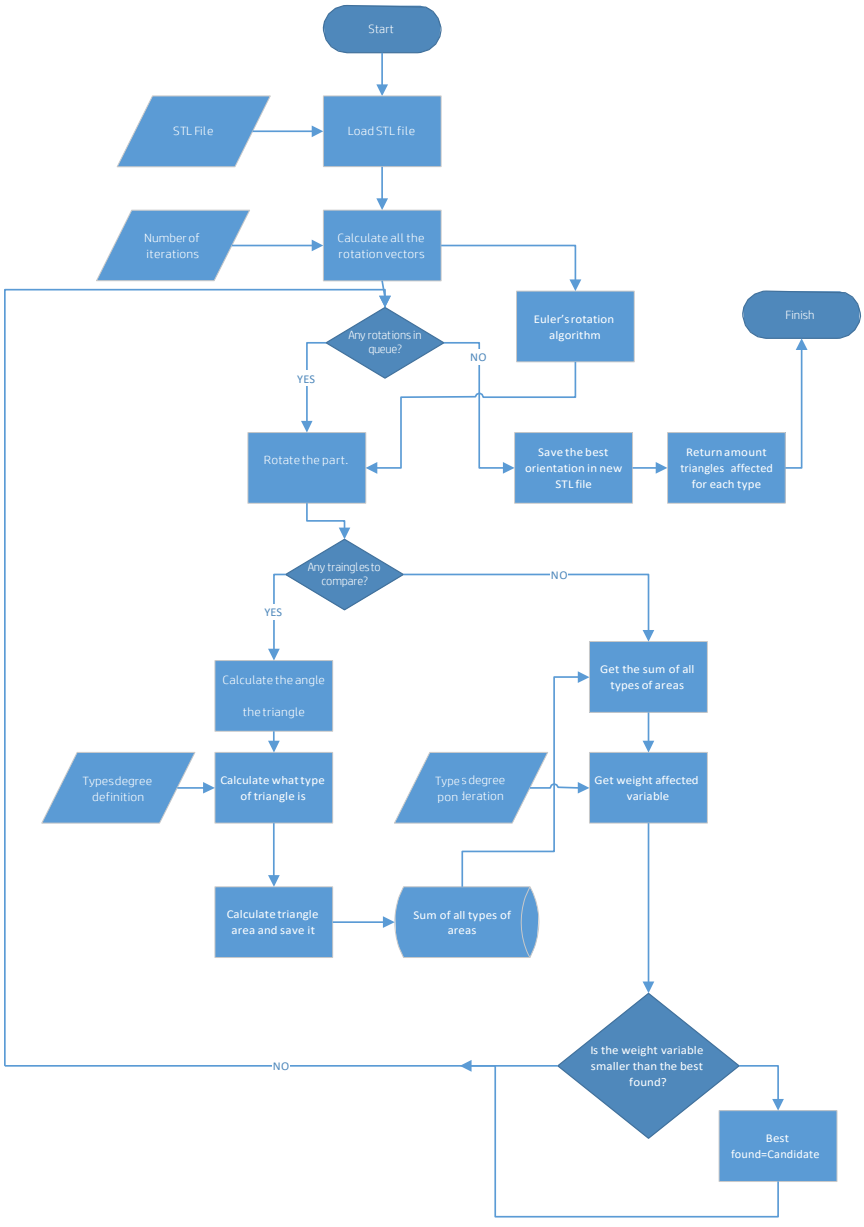

Figure 6: Algorithm workflow