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3D MULTILEVEL ALIGNMENT DIAGNOSTIC PROCEDURE FOR HIGHER DOT PLACEMENT ACCURACY AT REAL PARTS

HP INC

3D Multilevel alignment diagnostic procedure for higher dot placement accuracy at real parts

Abstract

3D printers are powerful tools for companies involved in prototyping since they can iterate designs much faster than other technologies. The main difference between HP MultiJet Fusion 3D and their competitors is the usage of agents to, accurately, generate and form the desired part's exact shape.

This accuracy is even more important when a customer starts optimizing and challenging the system by start printing low-volume parts (small, detailed parts, hollowed parts with thin walls, lattice, etc.) to improve its TCO by reducing printer material. In this type of application, the accuracy of the dot placement from the fluids at the media is very important as any small error could end with a high cosmetic issue or a drop on mechanical properties from the part.

On this document, it is described a procedure which allows the end customer to fine tune its machine alignment at a real voxel level – allowing to adjust 21um dot placement on a real 3D printed part.

Novelty

In this publication a fine-tuning alignment procedure using 3D printing parts is described. Therefore, allowing to adjust a dot displacement error of a voxel on a real printed part.

Problems Solved

For most of the current machines and part geometries, MJF system is performing well at dimensional accuracy. However, for some specific geometries, if the machine tolerances are not well adjusted, its current alignment procedure cannot align perfectly. This ends with some part quality problems on those parts (visual white lines and, sometimes, even some small steps than can be detected by touching the part)

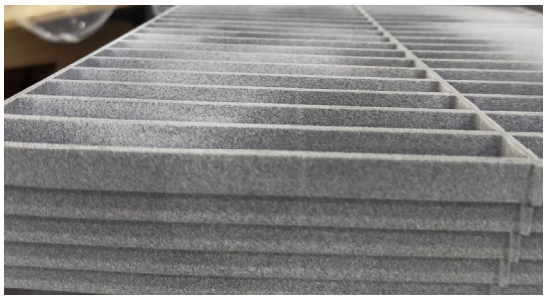


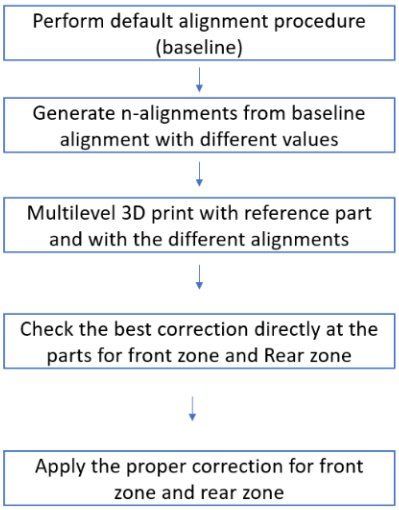
Figure 1: Lines on Parts Problem between PH due to alignment. Visual white line

In recent studies, it has been seen that this line and steps can be solved by slightly moving its alignment values, at a pixel level. As this finally depends on the HW machine tolerances, these values are different for each machine, the number of pixels needed to move, and the direction to move – rather in X or Y.

Description

Process description

To solve the problems of the lines on parts and to achieve the desired part quality, the following process must be followed:



For better explanation, each process is described:

1. *Perform default alignment procedure (baseline)*

To start the process is important to have the current default alignment. As any hardware machine change, or even any printhead change can affect this, it is important to do it just before starting this process.

2. *Generate n-alignments from baseline alignment with different values*

Default alignment can correct most part of the problem but to achieve the best conditions it still has some residual error. To improve it, range of small deviation alignments are generated with steps in X (carriage axis) and Y (recoater axis) to test them at the next step of printing.

3. *Multilevel 3D print with reference part and with the different alignments*

With the previous n-generated alignment, a real customer part can be printed several times in Z, using all of them. This part can be placed and the front and the rear, so any line that can appear at any printhead-to-printhead position might be corrected.

4. *Check the best correction directly at the parts for front zone and Rear zone*

Having all the parts already printed, they can all be visually inspected, and the customer can choose the best for front and rear zone. So, they will exactly know how their final parts will look like.

5. *Apply the proper correction for front zone and rear zone*

Once the final parts are chosen, the level selected must be introduced to the machine to correct the actual alignment values with the fine-tune ones.

Advantages

The two main advantages that the procedure presented in this publication solves are the following:

- Correct residual miss-alignment with real customer part quality criteria at a final 3D printed part.
- Improve yield of the system having better look and feel performance.

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