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Full step Z-resolution printing

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Title: Full Step Z resolution printing

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Abstract: This publication relates to an FFF 3D printer generating an interface layer between a raft and the print itself to increase dimensional accuracy, such that subsequent motion paths all conform to the full step resolution of the printers Z-axes.

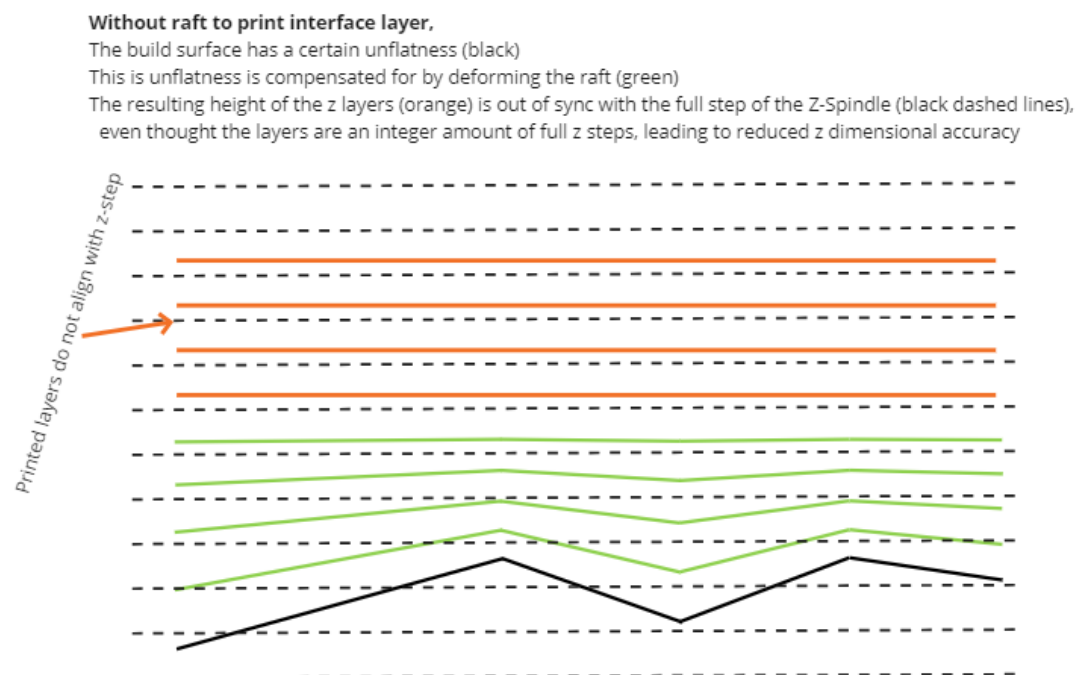
Rafts are widely used in FFF, see for example patent publication US2018354196 A1. Rafts are mostly used to prevent warping of the printed object and for providing a horizontal flat surface for the first layer of the printed final product.

Currently, some users already slice their print jobs to have increased dimensional accuracy in Z by only using a layer height that corresponds to an integer amount of full steps of a stepper motor in the Z axis. However, often the actual print is not executed at the actual full steps of the motor due to Z-homing offsets, and/or active bed compensation.

It is now proposed to let the FFF 3D printer produce a single extra layer in the print, i.e. in between the raft and the printed part, which extra layer serves to ensure that all layers of the print itself can be printed with the z-stepper set to a full step.

This can be achieved by measuring the bed as may be done by Ultimaker® printers, deforming a raft that was generated by a slicing program in such a way that the top layer of the raft becomes perfectly flat, then computing the required thickness of the interface layer such that the next layer is on a full z-step and generating and printing an interface raft layer on top of the slicer generated raft, and then applying a z-offset equal to this interface layer to the printed part.

Below, two examples are shown so as to better understand the proposed solution.



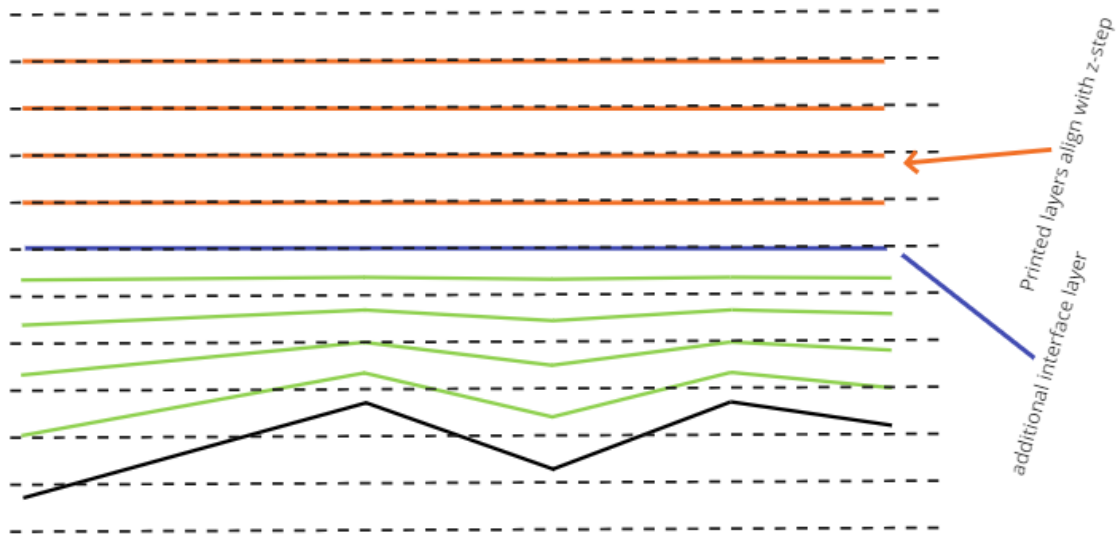
With raft to print interface layer,

The build surface has a certain unflatness (black)

This unflatness is compensated for by deforming the raft (green)

A single interface layer is inserted (blue) to align the next layers with the full step of the z-spindle (black dashed lines)

The resulting height of the z layers (orange) is perfectly aligned with the full step of the Z-Spindle (black dashed lines), leading to improved dimensional accuracy



The solution described above provides for an increased dimensional accuracy by eliminating micro-step rounding errors, and an increased z-stiffness during printing due to locking to a full step. This solution will improve the results of 3D prints manufactured by any FFF 3D printer using stepper motors to manipulate the z level of a build plate relative to a print nozzle.