Bed tilt compensation

Technical evaluation

Create it REAL
Your 3D printing technology provider

The purpose of this task is to evaluate

- How you structure your work
- Your coding skills
- Your conceptual understanding and math level
- How your document and communicate your work

Task description

3D printer bed surfaces can get a tilt during shipping or after some use. This makes the print unable to stick to the surface. Classically, we require the users to frequently level their print bed to eliminate this tilt, using the levelling screws. However, to increase the ease of use, we would like to automatically compensate for this tilt to have fault-free prints with no user maintenance required.

Create a method for bed tilt compensation. Initially we want a PC implementation in C# to verify the method. C++ is also acceptable. This has two main components:

Void PrepareTiltCompensation(Point3D, Point3D, Point3D);

This method prepares the tilt compensation algorithm with three measuring points on the bed surface. If the bed was completely levelled, these points would all have a Z-coordinate of 0. This measurement is performed once before each print to set up the compensation method.

Point3D ApplyTiltCompensation(Point3D);

This method is used change all the coordinates that the printer moves to. All input points are made with the assumption that the bed is the plane where Z = 0. The input points should then be changed to the plane given by the three measurement points of PrepareTilitCompensation().

Present your work with

- C# code. Use summaries and input descriptions for all methods.
- Unit tests.
- Diagram of the implementation to give a very quick overview.
- Considerations on how to optimize the code for an embedded implementation.

Resources

This functionality already exists in several open source 3D printer firmwares. Here the coordinates are taken from G-Code.

Check the methods in Marlin: *planner.cpp* as well as gcode_G29() in *Malin_main.cpp*. They work with "plan_bed_level_matrix". Find the rest of the marlin firmware here https://github.com/MarlinFirmware/Marlin

3D printer toolpaths are often defined using G-Code. You can find the G-Code standard on http://reprap.org/wiki/G-code.

Expanding the work

In case you finish your task, you can make some thoughts on expanding the functionality of the Bed Tilt Compensation.

The Bed tilt compensation is based on the assumption that the bed surface is completely flat. What would you propose if we wanted to compensate for both general tilt and surface roughness.