

Albert Wang

HW#1 ME480

STL of cube by hand, no errors:

```
solid cube
  facet normal 0.00000E+000 0.00000E+000 -1.00000E+000
    outer loop
      vertex 0.00000E+000 0.00000E+000 0.00000E+000
      vertex 3.00000E+000 0.00000E+000 0.00000E+000
      vertex 0.00000E+000 3.00000E+000 0.00000E+000
    endloop
  endfacet
  facet normal 0.00000E+000 0.00000E+000 -1.00000E+000
    outer loop
      vertex 0.00000E+000 3.00000E+000 0.00000E+000
      vertex 3.00000E+000 0.00000E+000 0.00000E+000
      vertex 3.00000E+000 3.00000E+000 0.00000E+000
    endloop
  endfacet
  facet normal -1.00000E+000 0.00000E+000 0.00000E+000
    outer loop
      vertex 0.00000E+000 0.00000E+000 0.00000E+000
      vertex 0.00000E+000 3.00000E+000 0.00000E+000
      vertex 0.00000E+000 3.00000E+000 3.00000E+000
    endloop
  endfacet
  facet normal -1.00000E+000 0.00000E+000 0.00000E+000
    outer loop
      vertex 0.00000E+000 0.00000E+000 0.00000E+000
      vertex 0.00000E+000 3.00000E+000 3.00000E+000
      vertex 0.00000E+000 0.00000E+000 3.00000E+000
    endloop
  endfacet
  facet normal 0.00000E+000 1.00000E+000 0.00000E+000
    outer loop
      vertex 0.00000E+000 3.00000E+000 3.00000E+000
      vertex 0.00000E+000 3.00000E+000 0.00000E+000
      vertex 3.00000E+000 3.00000E+000 3.00000E+000
    endloop
```

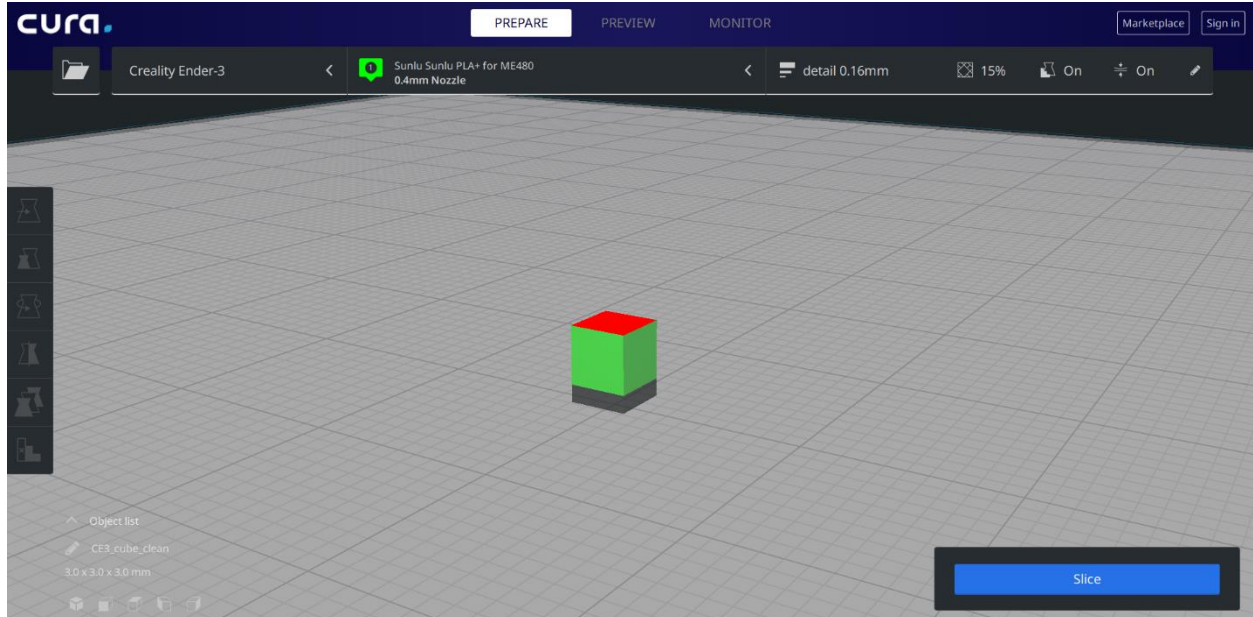
```

endfacet
facet normal 0.00000E+000 1.00000E+000 0.00000E+000
  outer loop
    vertex 3.00000E+000 3.00000E+000 3.00000E+000
    vertex 0.00000E+000 3.00000E+000 0.00000E+000
    vertex 3.00000E+000 3.00000E+000 0.00000E+000
  endloop
endfacet
facet normal 0.00000E+000 0.00000E+000 1.00000E+000
  outer loop
    vertex 3.00000E+000 3.00000E+000 3.00000E+000
    vertex 0.00000E+000 0.00000E+000 3.00000E+000
    vertex 0.00000E+000 3.00000E+000 3.00000E+000
  endloop
endfacet
facet normal 0.00000E+000 0.00000E+000 1.00000E+000
  outer loop
    vertex 3.00000E+000 3.00000E+000 3.00000E+000
    vertex 3.00000E+000 0.00000E+000 3.00000E+000
    vertex 0.00000E+000 0.00000E+000 3.00000E+000
  endloop
endfacet
facet normal 1.00000E+000 0.00000E+000 0.00000E+000
  outer loop
    vertex 3.00000E+000 3.00000E+000 0.00000E+000
    vertex 3.00000E+000 0.00000E+000 0.00000E+000
    vertex 3.00000E+000 3.00000E+000 3.00000E+000
  endloop
endfacet
facet normal 1.00000E+000 0.00000E+000 0.00000E+000
  outer loop
    vertex 3.00000E+000 3.00000E+000 3.00000E+000
    vertex 3.00000E+000 0.00000E+000 0.00000E+000
    vertex 3.00000E+000 0.00000E+000 3.00000E+000
  endloop

```

```
endfacet
facet normal 0.00000E+000 -1.00000E+000 0.00000E+000
  outer loop
    vertex 0.00000E+000 0.00000E+000 0.00000E+000
    vertex 0.00000E+000 0.00000E+000 3.00000E+000
    vertex 3.00000E+000 0.00000E+000 3.00000E+000
  endloop
endfacet
facet normal 0.00000E+000 -1.00000E+000 0.00000E+000
  outer loop
    vertex 0.00000E+000 0.00000E+000 0.00000E+000
    vertex 3.00000E+000 0.00000E+000 3.00000E+000
    vertex 3.00000E+000 0.00000E+000 0.00000E+000
  endloop
endfacet
endsolid cube
```

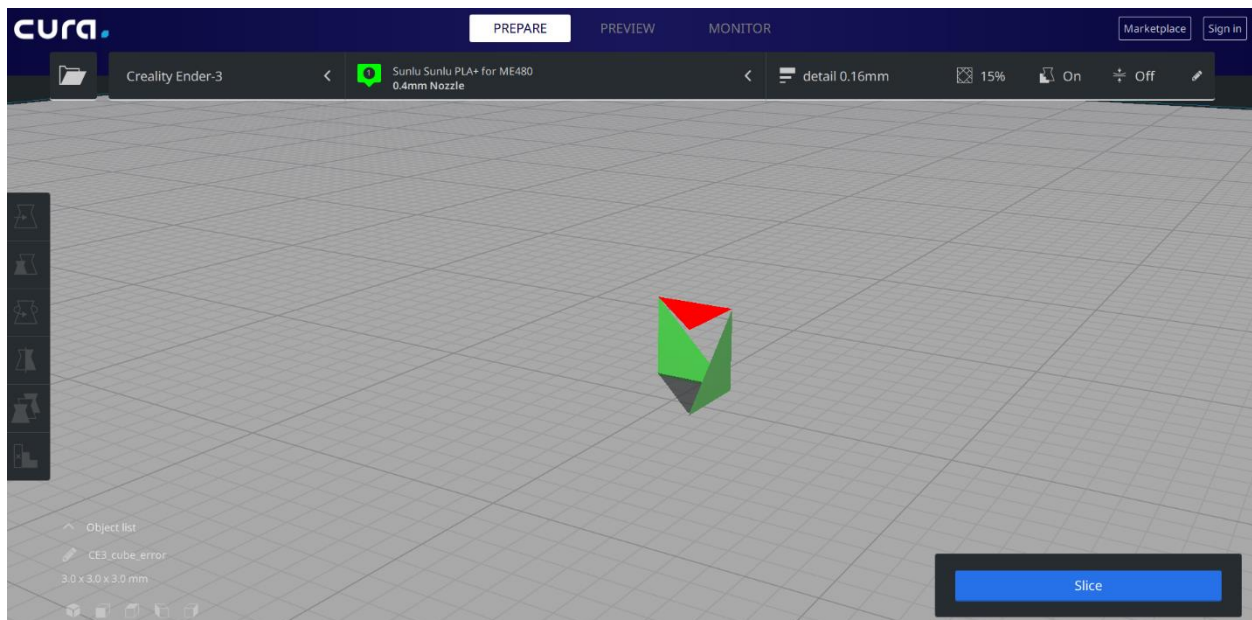
Screenshot of cura rendition – cube STL with no errors



STL of cube by hand, errors (missing triangles):

```
solid cube
  facet normal 0.00000E+000 0.00000E+000 1.00000E+000
    outer loop
      vertex 3.00000E+000 3.00000E+000 3.00000E+000
      vertex 3.00000E+000 0.00000E+000 3.00000E+000
      vertex 0.00000E+000 0.00000E+000 3.00000E+000
    endloop
  endfacet
  facet normal 1.00000E+000 0.00000E+000 0.00000E+000
    outer loop
      vertex 3.00000E+000 3.00000E+000 0.00000E+000
      vertex 3.00000E+000 0.00000E+000 0.00000E+000
      vertex 3.00000E+000 3.00000E+000 3.00000E+000
    endloop
  endfacet
  facet normal 0.00000E+000 -1.00000E+000 0.00000E+000
    outer loop
      vertex 0.00000E+000 0.00000E+000 0.00000E+000
      vertex 3.00000E+000 0.00000E+000 3.00000E+000
      vertex 3.00000E+000 0.00000E+000 0.00000E+000
    endloop
  endfacet
endsolid cube
```

Screenshot of cura rendition – “cube” STL with errors



Gcode of unit cube by hand: absolute positioning with start and stop code for ender 3 machine:

```
M201 X500.00 Y500.00 Z100.00 E5000.00 ;Setup machine max acceleration
M203 X500.00 Y500.00 Z10.00 E50.00 ;Setup machine max feedrate
M204 P500.00 R1000.00 T500.00 ;Setup Print/Retract/Travel acceleration
M205 X8.00 Y8.00 Z0.40 E5.00 ;Setup Jerk
M220 S100 ;Reset Feedrate
M221 S100 ;Reset Flowrate
```

```
G28 ;Home
```

```
G92 E0 ;Reset Extruder
G1 Z2.0 F3000 ;Move Z Axis up
G1 X10.1 Y20 Z0.28 F5000.0 ;Move to start position
G1 X10.1 Y200.0 Z0.28 F1500.0 E15 ;Draw the first line
G1 X10.4 Y200.0 Z0.28 F5000.0 ;Move to side a little
G1 X10.4 Y20 Z0.28 F1500.0 E30 ;Draw the second line
G92 E0 ;Reset Extruder
G1 Z2.0 F3000 ;Move Z Axis up
```

```
G1 X0 Y0 Z0 ;Home to corner 1 z0 plane
G1 X1 Y0 Z0 F100 ;to corner 2 z0 plane
G1 X1 Y1 Z0 F100 ;to corner 3 z0 plane
G1 X0 Y1 Z0 F100 ;to corner 4 z0 plane
G1 X0 Y1 Z1 F100 ;to corner 4 z1 plane
G1 X0 Y0 Z1 F100 ;to corner 1 z1 plane
G1 X1 Y0 Z1 F100 ;to corner 2 z1 plane
G1 X1 Y1 Z1 F100 ;to corner 3 z1 plane
```

```
G91 ;Relative positionning
G1 E-2 F2700 ;Retract a bit
G1 E-2 Z0.2 F2400 ;Retract and raise Z
G1 X5 Y5 F3000 ;Wipe out
G1 Z10 ;Raise Z more
G90 ;Absolute positionning
```

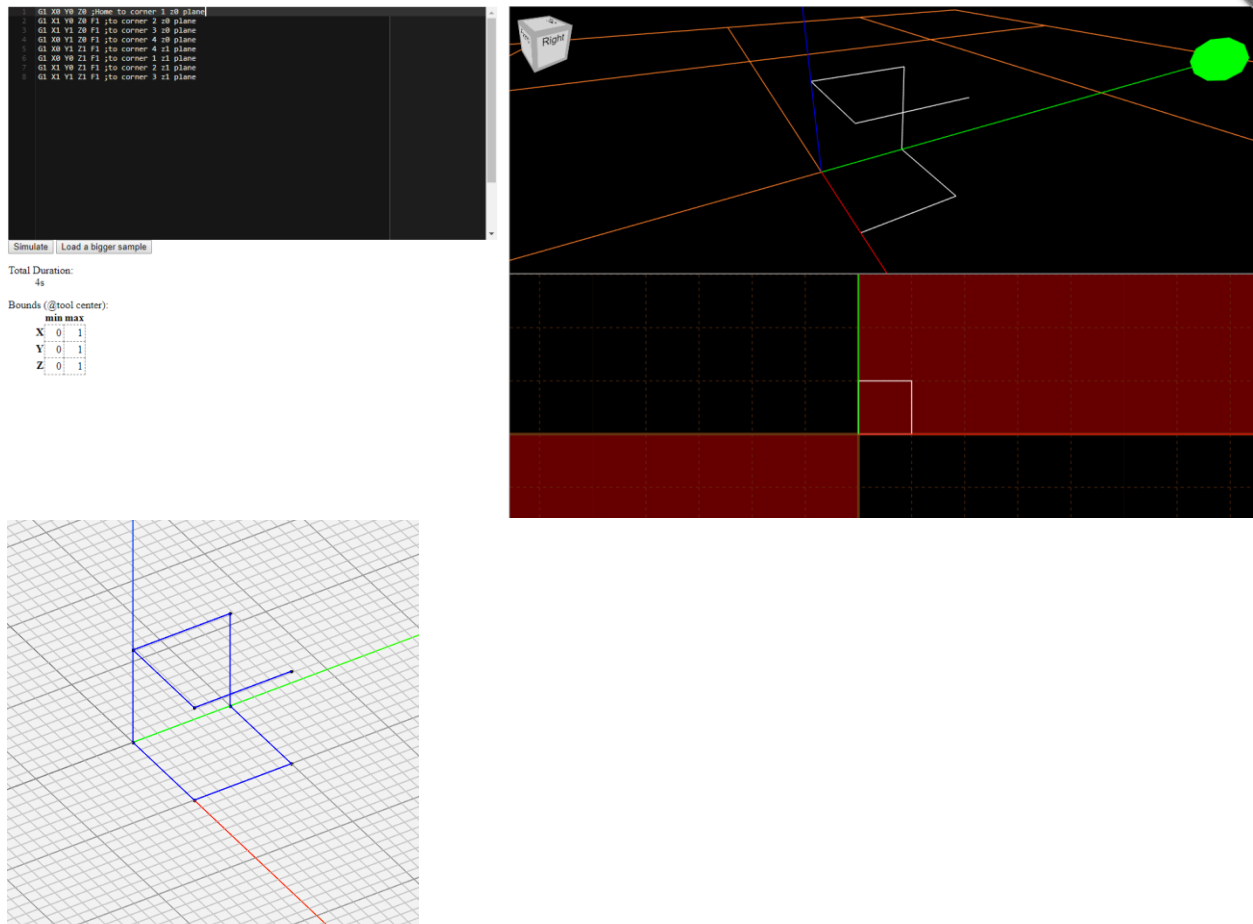
```
G1 X0 Y{machine_depth} ;Present print
M106 S0 ;Turn-off fan
M104 S0 ;Turn-off hotend
M140 S0 ;Turn-off bed
```

```
M84 X Y E ;Disable all steppers but Z
```


Visualization of g-code file (absolute):

G-Code Q'n'dirty toolpath simulator

Paste your g-code in the left-hand window or drop a file on the page and see the preview of your tool path on the right.
The right-hand pane are interactive, drag them to change the point of view:



Gcode manually of unit cube using relative positioning:

G90 ;absolute positioning

G1 X0 Y0 Z0 ;Home to corner 1 z0 plane

G91 ;relative positioning

G1 X1 F100 ;to corner 2 z0 plane

G1 Y1 F100 ;to corner 3 z0 plane

G1 X-1 F100 ;to corner 4 z0 plane

G1 Z1 F100 ;to corner 4 z1 plane

G1 Y-1 F100 ;to corner 1 z1 plane

G1 X1 F100 ;to corner 2 z1 plane

G1 Y1 F100 ;to corner 3 z1 plane|

Visualization of g-code file (relative):

G-Code Q'n'dirty toolpath simulator

Paste your g-code in the left-hand window or drop a file on the page and see the preview of your tool path on the right.
The right-hand pane are interactive, drag them to change the point of view:

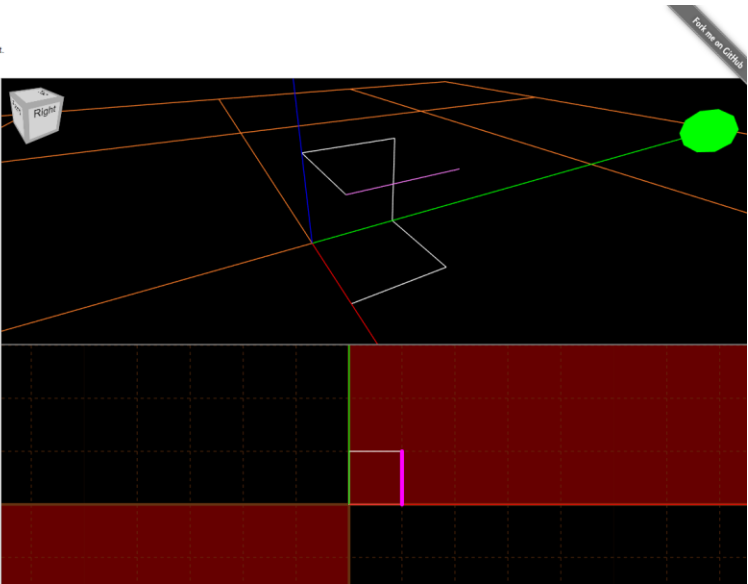
```
1 G90 absolute positioning
2 G1 X0 Y0 Z0 ;move to corner 1 28 plane
3
4 G91 relative positioning
5 G1 X1 F100 ;to corner 2 28 plane
6 G1 Y1 F100 ;to corner 3 28 plane
7 G1 X-1 F100 ;to corner 4 28 plane
8 G1 Z1 F100 ;to corner 4 21 plane
9 G1 Y-1 F100 ;to corner 1 21 plane
10 G1 X1 F100 ;to corner 2 21 plane
11 G1 Y1 F100 ;to corner 3 21 plane
```

[Simulate](#) [Load a bigger sample](#)

Total Duration:
4s


Bounds (@tool center):

	min	max
X	0	1
Y	0	1
Z	0	1



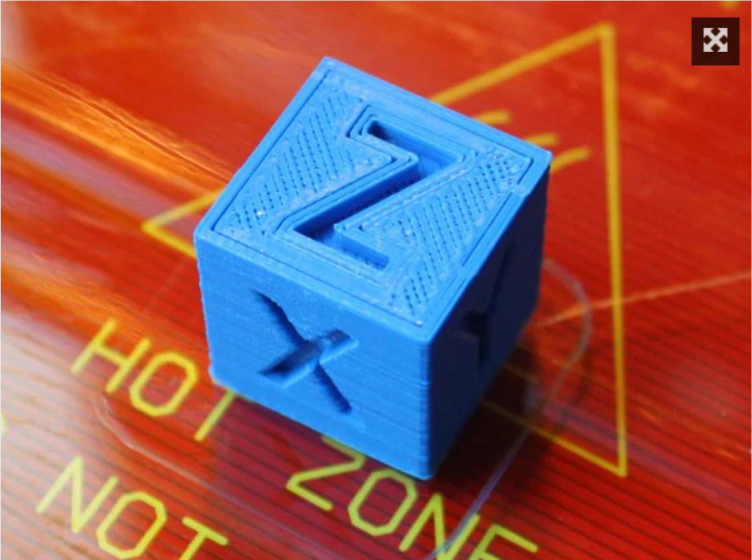
Infills:

Using an xyz 20mm calibration cube, the model was sliced in cura using gyroid, line, and trihex infills.



XYZ 20mm Calibration Cube

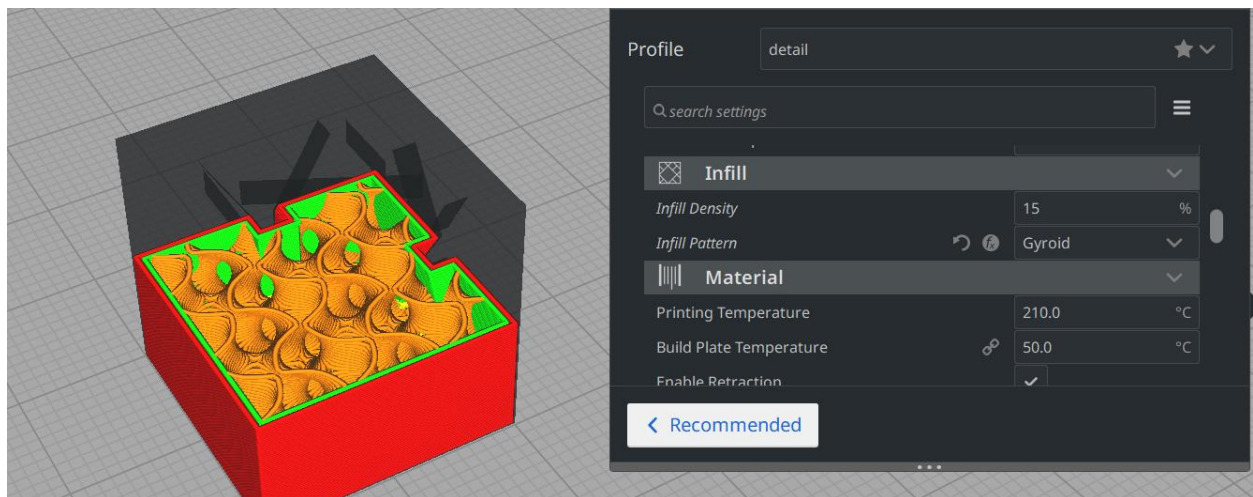
by [iDig3Dprinting](#) Jan 19, 2016



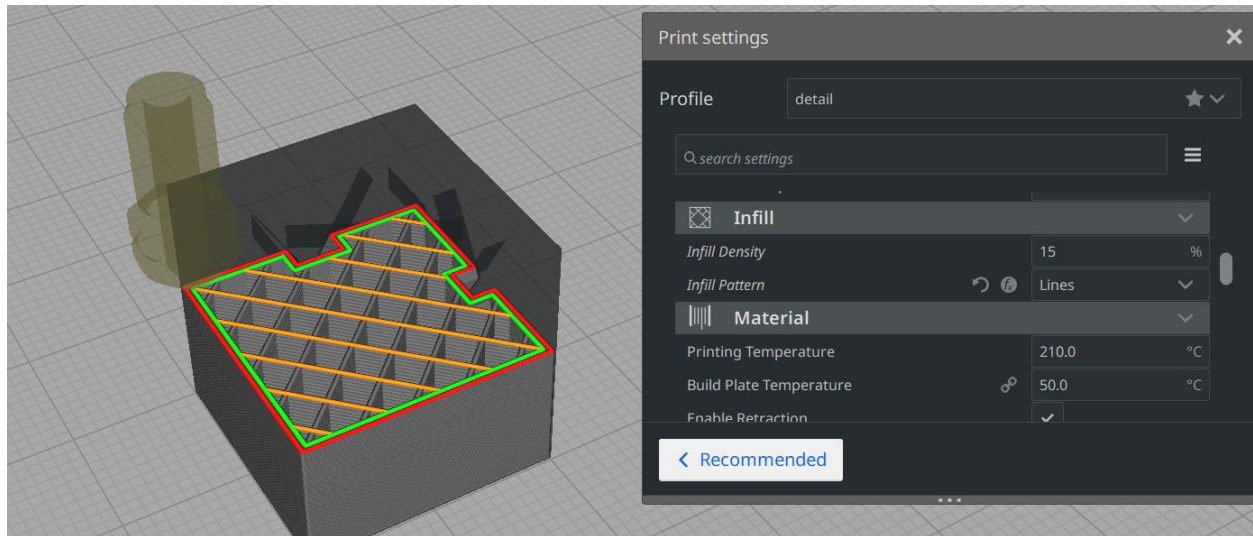
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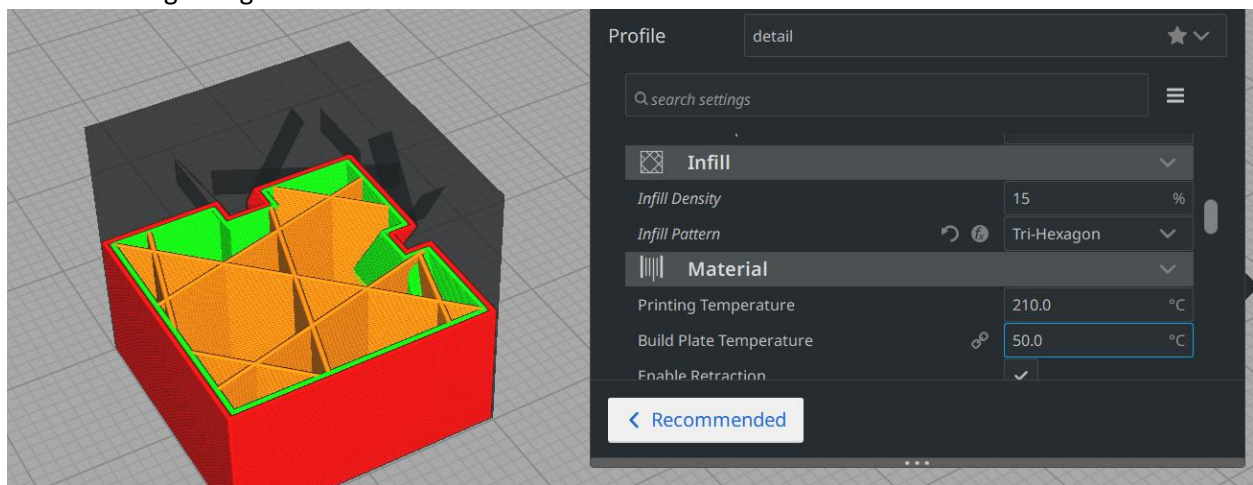
Thing Apps Enabled



Gyroid: looks cool, prints on every later and fills 3d space allowing better strength distribution throughout the model in all directions. Takes longer to print + more material, more memory in file storage, and has overhangs which could lead to print failures.



Line: quick to print, doesn't use much material and is easy to calculate paths for. Doesn't print on all directions every layer, so infill is weaker, and "draping" lines at different heights can lead to uneven surfaces along z height.



Trihex: A good middle ground between gyroid and line. Prints every layer and in multiple directions per layer so strength is better distributed in 3d space, but without overhangs. Makes straight line moves so computational space and time spent is lesser than gyroid. Downside is you don't get the full benefits of a simple (line) or a complex (gyroid) infill by compromising on certain features.