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3D Printer Programming

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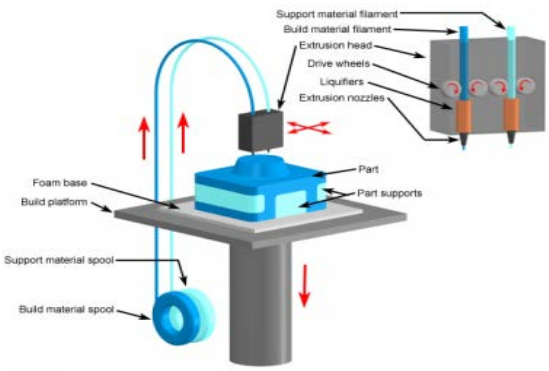
Abstract— ***3D printing (also known as Additive Manufacturing Process, AM) is any of various processes used to make a three-dimensional object without the use of dies, molds or machining. In 3D printing, additive processes are used, in which successive layers of material are laid down under computer control. These objects can be of almost any shape or geometry, and are produced from a 3D model or other electronic data source. A 3D printer is a type of industrial robot.***

3D printing Ceramic in the term's original sense refers to processes that sequentially deposit material onto a powder bed with inkjet printer heads. More recently the meaning of the term has expanded to encompass a wider variety of techniques such as extrusion and sintering based processes. Technical standards generally use the term additive manufacturing for this broader sense.

***Index Terms*—3D printing, Ceramic, without mould, without machining**

I. 3D PRINTING

It is widely believed that 3D printing or Additive Manufacturing (AM) has the vast potential to become one of these technologies. The most basic, differentiating principle behind 3D printing is that it is an additive manufacturing process. And this is indeed the key because 3D printing is a radically different manufacturing method based on advanced technology that builds up parts, additively, in layers at the sub mm scale. This is fundamentally different from any other existing traditional manufacturing techniques.



There are a number of limitations to traditional manufacturing, which has widely been based on human labor and “made by hand” ideology rooting back to the etymological origins of the French word for manufacturing itself. However, the world of manufacturing has changed, and automated processes such as machining, casting, forming and molding are all presently working processes, complex processes that require machines, computers and robot technology. However, these technologies all demand subtracting material from a larger block whether to achieve the end product itself or to produce a tool for casting or molding processes and this is a serious limitation within the overall manufacturing process.

In contrast, 3D printing is a process for creating objects directly, by adding material layer by layer in a variety of ways, depending on the technology used. Simplifying the ideology behind 3D printing, for anyone that is still trying to understand the concept (and there are many), it could be likened to the process of building something with Lego blocks automatically.3D printing is an enabling technology that encourages and drives innovation with unprecedented design freedom while being a tool-less process that reduces prohibitive costs and lead times. Components can be designed specifically to avoid assembly requirements with intricate geometry and complex features created at no extra cost.

3D printing is also emerging as an energy-efficient technology that can provide environmental efficiencies in terms of both the manufacturing process itself, utilizing up to 90% of standard materials, and throughout the product’s

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operating life, through lighter and stronger design. In recent years, 3D printing has gone beyond being an industrial prototyping and manufacturing process as the technology has become more accessible to small companies and even individuals.

II. PROGRAMMING

```
;generated by Slic3r 1.0.0RC2
; layer_height = 0.4
; perimeters = 3
; top_solid_layers = 3
; bottom_solid_layers = 3
; fill_density = 0.4
; perimeter_speed = 30
; infill_speed = 60
; travel_speed = 130
; nozzle_diameter = 0.5
; filament_diameter = 3
; extrusion_multiplier = 1
; perimeters extrusion width = 0.50mm
; infill extrusion width = 0.53mm
; solid infill extrusion width = 0.53mm
; top infill extrusion width = 0.53mm
; first layer extrusion width = 0.70mm
G21 ; set units to millimeters
M107
M104 S200 ; set temperature
G28 ; home all axes
G1 Z5 F5000 ; lift nozzle
M109 S200 ; wait for temperature to be reached
G90 ; use absolute coordinates
G92 E0
M82 ; use absolute distances for extrusion
G1 F1800.000 E-1.00000
G92 E0
G1 Z0.350 F7800.000
G1 X82.053 Y79.823 F7800.000
G1 E1.00000 F1800.000
G1 X82.663 Y79.263 E1.02694 F540.000
G1 X83.433 Y78.673 E1.05850
G1 X84.343 Y78.113 E1.09327
G1 X84.923 Y77.813 E1.11451
G1 X85.793 Y77.443 E1.14527
G1 X86.423 Y77.223 E1.16698
G1 X87.403 Y76.953 E1.20005
G1 X87.943 Y76.853 E1.21792
G1 X88.643 Y76.763 E1.24088
G1 X113.583 Y74.843 E2.05471
G1 X114.983 Y74.773 E2.10032
G1 X115.833 Y74.783 E2.12798
G1 X116.553 Y74.843 E2.15148
G1 X117.703 Y75.013 E2.18930
G1 X118.353 Y75.143 E2.21087
G1 X118.903 Y75.293 E2.22942
G1 X119.733 Y75.553 E2.25772
G1 X120.393 Y75.793 E2.28057
G1 X121.613 Y76.373 E2.32452
G1 X122.303 Y76.763 E2.35030
G1 X122.733 Y77.043 E2.36700
G1 X123.753 Y77.803 E2.40838
G1 X124.363 Y78.333 E2.43467
G1 X124.893 Y78.853 E2.45883
G1 X125.353 Y79.353 E2.48094
G1 X126.043 Y80.213 E2.51681
G1 X126.453 Y80.803 E2.54019
G1 X126.823 Y81.403 E2.56312
G1 X127.163 Y82.023 E2.58613
G1 X127.453 Y82.603 E2.60722
G1 X127.933 Y83.793 E2.64897
G1 X128.133 Y84.413 E2.67017
G1 X128.333 Y85.133 E2.69448
G1 X128.523 Y86.033 E2.72441
G1 X128.643 Y86.933 E2.75395
G1 X128.703 Y87.813 E2.78264
G1 X128.703 Y88.413 E2.80217
G1 X128.663 Y89.163 E2.82660
G1 X126.383 Y109.353 E3.48766
G1 X103.646 Y114.206 E2.95975
G1 X103.132 Y113.722 E2.98273
G1 X102.673 Y113.217 E3.00493
G1 X102.201 Y112.607 E3.03000
G1 X101.969 Y112.258 E3.04363
G1 X101.526 Y111.453 E3.07353
G1 X101.425 Y111.232 E3.08144
G1 X101.093 Y110.304 E3.11352
G1 X100.939 Y109.597 E3.13706
G1 X100.736 Y107.728 E3.19823
G1 X98.100 Y107.383 E3.28475
G1 X97.357 Y109.310 E3.35195
G1 X97.166 Y109.708 E3.36630
G1 X97.043 Y109.939 E3.37482
G1 X96.531 Y110.741 E3.40580
G1 X96.270 Y111.082 E3.41974
G1 X95.763 Y111.658 E3.44472
G1 X95.279 Y112.126 E3.46662
G1 X94.875 Y112.465 E3.48378
G1 X94.112 Y113.005 E3.51419
G1 X93.875 Y113.152 E3.52326
G1 X92.835 Y113.678 E3.56118
G1 X91.551 Y114.108 E3.60523
G1 X90.835 Y114.257 E3.62903
G1 X90.385 Y114.319 E3.64381
G1 X89.415 Y114.372 E3.67543
G1 X89.175 Y114.366 E3.68323
G1 X87.975 Y114.243 E3.72249
G1 X86.831 Y113.944 E3.76095
G1 X85.730 Y113.450 E3.80019
G1 X84.663 Y112.748 E3.84176
G1 X83.746 Y111.925 E3.88188
G1 X83.613 Y111.786 E3.88813
G1 X82.951 Y110.987 E3.92187
G1 X82.681 Y110.604 E3.93713
G1 X82.289 Y109.962 E3.96160
G1 X81.715 Y108.760 E4.00492
G1 X81.336 Y107.608 E4.04439
G1 X81.218 Y107.104 E4.06123
G1 X81.101 Y106.385 E4.08493
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G1 X81.032 Y104.953 E4.13157
G1 X81.138 Y103.874 E4.16684
G1 X81.188 Y103.597 E4.17599
G1 X81.420 Y102.707 E4.20594
G1 X81.558 Y102.304 E4.21978
G1 X81.867 Y101.574 E4.24558
G1 X82.177 Y100.980 E4.26738
G1 X82.466 Y100.503 E4.28551
G1 X83.029 Y99.715 E4.31703
G1 X83.192 Y99.516 E4.32539
G1 X126.074 Y113.130 E1.93670 F1200
G1 X126.342 Y113.013 E1.94120 F1200
G1 X126.148 Y112.819 E1.94543 F1200
G1 X126.397 Y112.684 E1.94980 F1200
G1 X126.221 Y112.508 E1.95363 F1200
G1 X126.440 Y112.341 E1.95786 F1200
G1 X126.269 Y112.171 E1.96156 F1200
G1 X126.471 Y111.988 E1.96576 F1200
G1 X126.306 Y111.823 E1.96934 F1200
G1 X126.482 Y111.615 E1.97355 F1200
G1 X126.342 Y111.474 E1.97660 F1200
G1 X126.494 Y111.241 E1.98088 F1200
G1 X126.378 Y111.125 E1.98341 F1200
G1 X126.506 Y110.868 E1.98783 F1200
G1 X126.379 Y110.742 E1.99058 F1200
G1 X126.517 Y110.495 E1.99493 F1200
G1 X126.381 Y110.359 E1.99790 F1200
G1 X126.519 Y110.112 E2.00225 F1200
G1 X126.382 Y109.976 E2.00522 F1200
G1 X126.468 Y109.677 E2.01001 F1200
G1 X126.382 Y109.591 E2.01188 F1200
G1 X126.418 Y109.242 E2.01728 F1200
G1 X126.346 Y109.170 E2.01884 F1200
G1 X126.367 Y108.806 E2.02445 F1200
G1 X126.310 Y108.750 E2.02569 F1200
G1 X126.317 Y108.371 E2.03151 F1200
G1 X126.217 Y108.271 E2.03368 F1200
G1 X126.209 Y107.879 E2.03973 F1200
G1 X126.121 Y107.791 E2.04165 F1200
G1 X126.062 Y107.347 E2.04854 F1200
G1 X126.042 Y107.327 E2.04897 F1200
G1 X125.787 Y106.406 F7800.000
G1 X125.763 Y106.381 E2.04948 F1200
G1 F1800.000 E1.04948
G92 E0
G1 X109.639 Y124.838 F7800.000
G1 E1.00000 F1800.000
G1 X109.674 Y124.873 E1.00140 F1200
G1 F1800.000 E0.00140
G92 E0
M107
M104 S0 ; turn off temperature
G28 X0  ; home X axis
M84     ; disable motors
; filament used = 1003.8mm (7.1cm3)
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III. CONCLUSION

3d printing technology could revolutionize and re-shape the world. Advances in 3D printing technology can significantly change and improve the way we manufacture products and produce goods worldwide. The importance ofd an invention can be appraised by determining the which of the human needs it fulfills and 3D Printing can hacve an application in almost all of the categories of human needs. It will provide companies and individuals fast and easy manufacturing in any size or scale limited only by their imagination.

After the arrival of 3D Printing futurist predicted that we'd soon see them in every home. In future consumers will probably make what they want at home with their own 3D Printers. If someone wants a latest fashion toy. They will buy the 3D file instead of the product. One day we may have 3D Printer that use nanotechnology to create products by depositing them atom by atom. Simple machinery has been created at the atomic scale such as small wheels, transistors and "walking DNA". These could be the precursors to more advanced custom manufacturing system.

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