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3D Printing

Fiction to Fruition

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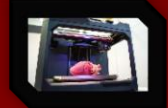


Objectives

- Explain How 3D Printers Work
- Understand Math Involved In 3D Printing
- Applications of 3D Printing



Printed in 24 hours for less than 11k.



Bioprinter prototype heart

Our 3D Printing Progress

How It Works: 3D Printing

- For starters, 3D printers use a special type of code language called, "G-Code".
- G-Code consists of G- and M-commands. G-commands are responsible for telling the 3D Printer where and how to move, whilst M-commands are responsible for telling the machine miscellaneous functions, such as: starting and stopping.
- The Figure below is an example of how a single line of G-Code looks like.

```
11 G1 F900 X197.600 Y29.900 E19.82400
```

Line Of Code // G or M command // Speed

XY coordinates (Z is the number of layer)

Feeder(rate of extrusion)



0%



50%



100%

Math Involved:

- 3D printers purely use basic geometry to translate dimensions and properties of a desired object from code to reality.
- Many 3D modeling programs, such as: Cura, Fusion 360 and Pruca Slicer, almost entirely rely on the use of the X Y Z dimensions to bring about models into fruition.
- Those models created can then be translated into G-Code, using the same basic mathematical geometrical principles, and, finally, inserted into the 3D Printer to allow it to begin its work.

- For Example:

```
64 G1 X77.384 Y69.469 E0.113
65 G1 X77.894 Y69.167 E0.13271
66 G1 X90.631 Y61.814 E0.62187
67 G1 X91.378 Y61.397 E0.65033
68 G1 X92.217 Y60.977 E0.68153
69 G1 X93.088 Y60.629 E0.71273
70 G1 X93.985 Y60.357 E0.74391
71 G1 X94.903 Y60.162 E0.77512
72 G1 X95.833 Y60.046 E0.80629
73 G1 X96.771 Y60.01 E0.83751
74 G1 X97.966 Y60.08 E0.87733
75 G1 X98.886 Y60.186 E0.90813
76 G1 X99.982 Y60.326 E0.94488
77 G1 X102.469 Y60.572 E1.028
```

Some Applications Of 3D Printing:

- Education: 3D printing has the potential to empower students like never before, allowing room for creativity, innovation and freedom not possible prior. With low-budget rapid 3D printers, students will be able to easily construct complex models, such as: chemical compounds, cross-section of organs in the human body or other specimens.
- Medical Industry: 3D printing provides the ability for doctors to produce prosthetics with ease and efficiency at a lower cost for all kinds of patients. Also, 3D printing brought about a process called, "bioprinting". Bioprinting is the replication of bodily structures to produce functional artificial counterparts, which can then be transplanted into patients to improve quality of life, or even save lives.
- Construction: 3D printing in construction can be used to fabricate buildings and construction components. There are multiple processes which are widely used in construction nowadays that heavily rely on 3D printing, such as: extrusion, powder bonding and additive welding. This revolutionizes construction by allowing faster construction, more complexity and accuracy, lower labor costs and less waste.