

An Overview of 3D Printing Technology and its Applications

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Abstract: 3D printers are an advanced generation of machines that can produce day-to-day things. There are benefits of consideration because they can make different group of things having similar characteristic of objects in different material from the same machine. A 3D printer can make pretty much anything from pottery cups to plastic toys, metal machine parts, firing container, decorative chocolate cakes or even human body parts. 3D printers provide product creators the capability to print parts and components that are made from different concretes which have various automatic and concrete assets in a single build process. 3D printing is accomplished using an additive process, where consecutive sheets of objectives are set down in different aspects.

Keywords: 3D printers, different materials, additive process, consecutive sheets.

I. INTRODUCTION

3D printing is a way by which 3D solid entities of any shape or geometry can be created from a digital file. The creation is achieved by laying down sequential sheets of a specific material until the entire entity is created. Each of these sheets represents a thinly carve horizontal cross-section of the conditional object, in contrast to traditional subtractive constructing methods which relies upon the removal of material to create something. There are a lot of similar analysis and terminologies used to describe 3D printing such as additive manufacturing, and rapid patterning.

II. HISTORY OF 3D PRINTING TECHNOLOGY

The primitive document of 3D printing through the additive process was the Japanese inventor Hideo Kodama in 1981. He created a product that used ultraviolet lights to harden polymers and create solid entities. This is a stepping stone to stereo lithography (SLA). Charles Hull created stereo lithography a process similar to 3D printing that uses technology to create smaller versions of entities so they can be tested before spending time and money on creating the actual product. The object is printed sheet by sheet soaked with a solvent, and toughened with an ultraviolet light. The technique uses computer-aided designs (CAD) to create the 3D models.

III. WHAT IS 3D PRINTING?

3D Printing, also known as additive manufacturing, defines a fabrication method in which an entity is formed in three dimensions often through a range of sequential layers. There are many techniques to consider under the umbrella of 3D printing, and also a great number of components. "Additive" refers to the successive addition of thin layers between 16 to 180 microns or more to create an entity. In fact, all 3D printing technologies are similar, as they construct an object sheet by sheet to create complicated aspects.

IV. WORKING PRINCIPLE OF 3D PRINTER

There are certain steps in 3d printing,

a) CAD MODEL CREATION

First the entity to be built is a modelled using a COMPUTER-AIDED DESIGN(CAD) software package solid modellers, such as PRO/ENGINEER tend to perform 3D entity more exactly than wire frame modellers such as AutoCAD and will therefore yield better results. This procedure is identical for all of the rapid prototyping build techniques.

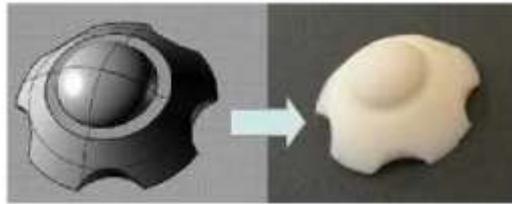


Figure 1.1

b) CONVERSION TO STL FORMAT:

STL is a file format endemic to the stereolithography CAD software created by 3D Systems. STL has some backronyms such as Standard Triangle Language and Standard Tessellation Language. This file format is supported by many other software packages it is broadly used for rapid prototyping, 3D printing and computer-aided manufacturing.

To establish consistency STL format has been adopted as the standard of the rapid prototyping industry. The second step, therefore, is to convert the CAD file into STL format represents a three-dimensional surface as assembly of planer triangles. STL files uses planar elements, they cannot represent curved surfaces exactly.

AUTO DESK

- File menu-save copy As
- Select STL from the types drop down
- Check options-choose high(for quality surface)
- Click save

CATIA

- Select STL command
- Select the model, then select yes
- Select Export, ok.

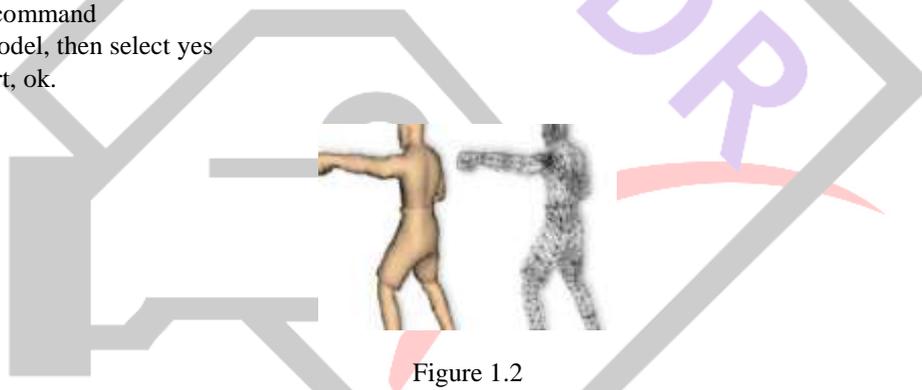


Figure 1.2

c) SLICE THE STL FILE:

In third step, a pre-processing program arranges the STL file to be built. The pre-processing software slices the STL model into a number of layers from 0.01mm to 0.7mm thick, depending on the build technique. The program may also generate an auxiliary framework to support the model during the build. Supports are useful for gentle features such as commands, internal cavities, and thin-walled sections.



Figure 1.3

d) LAYER BY LAYER CONSTRUCTION

The fourth step is construction of the part. Rapid prototyping machines build one layer at a time from polymers, paper, or powdered metal. Most machines are fairly autonomous, needing little human intervention.

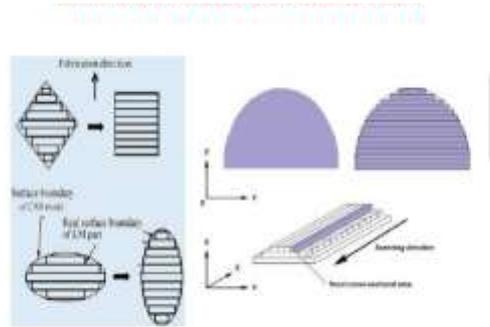


Figure 1.4

e) CLEAN AND FINISH

The final step is post-processing. This involves removing the prototype from the machine and detaching any parts. Some photosensitive materials need to be fully cured before use. Prototypes may also require minor cleaning and surface treatment. Sanding, sealing and/or painting the model will improve its presentation and endurance.



Figure 1.5

V. 3D PRINTING SOFTWARE

3D printing software categorized into 3D modelling software and slicing software.

a) 3D MODELLING SOFTWARE

3D modelling is the process of advancing a mathematical representation of any surface of an object in three dimensions via specialized software. The product is called a 3D model

1. SOLIDWORKS

Solid Works is a solid designing computer-aided design (CAD) and computer-aided engineering (CAE) computer program that runs on Microsoft Windows. Solid Works is published by Dassault Systems.

b) SLICING SOFTWARE

The slicing software is computer software used in the majority of 3D printing processes for the conversion of a 3D object model to definite instructions for the printer. In particular, the conversion from a model in STL format to printer commands in g-code format in fused filament production and other similar processes.

1. ULTIMAKER CURA

Cura can be used in any 3D printer because it is an open-source slicer. The program is intuitive, fast and easy to use.

VI. CLASSIFICATION OF 3D PRINTING SYSTEMS

a) LIQUID BASED SYSTEMS

In this system the prototypes are developed by hardening the photopolymer resins with help of the UV rays and other types of lasers.

Example: Stereo lithography apparatus, Solid ground curing

b) SOLID BASED SYSTEMS

In this method the prototypes are developed by heating and melting the raw materials which is in a solid form.

Example: Laminated Object Manufacturing, Fusion deposition modelling.

c) POWDER BASED SYSTEMS

In this method the prototypes are developed by binding the powdered raw materials or melting the powdered raw materials and allowing them to fuse.

Example: Selective laser sintering, Electron beam melting process.

VII .APPLICATIONS OF 3D PRINTER

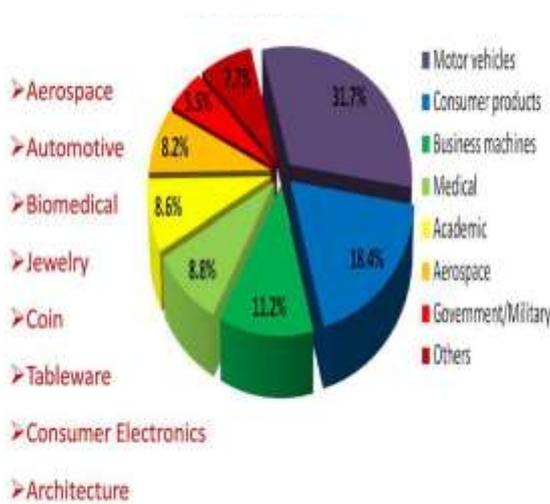


Figure 1.6

a) AEROSPACE

The Aerospace and Defence industry is a good example of application Additive Manufacturing with a clear value proposition and the ability to create parts that are stronger and lighter than parts made using traditional manufacturing.



Figure 1.7

b) AUTOMOTIVE

For the automotive industry recent advances in Additive Manufacturing (AM) (or 3D Printing) have opened doors for newer, more robust designs, lighter, stronger, and safer products; reduced lead times, and reduced costs. While automotive authentic constructs

manufacturers (OEMs) and suppliers constitutionally use AM for rapid prototyping, the technical trajectory of AM makes a strong case for its use in product innovation and direct manufacturing in the future.



Figure 1.8

c) BIOMEDICAL

Lesions and defects that require tissue or organ transplantation remain urgent problems in clinical medicine, and problems still exist regarding the use of current access, which include auto-transplantation, xenon -transplantation, and the announcement of artificial mechanical organs. Three-dimensional (3D) printing technology is expected to solve the limitations that are imminent encountered when using traditional methods by incorporating the personalized development of human bionic tissue or organs.



Figure 1.9

d) CONSUMER PRODUCTS

Mass customization is one of the main process in which 3D printing will change the face of consumer products. Anything can be 3D printed these days plastics with interlinking parts, transparent material, gold, silver, and bronze. Even materials such as pottery cups or titanium can be printed.



Figure 1.10

e) ARCHITECTURE

3D printing is used to design house blueprint, building structures, town and city planning. Bridges and Dams that would need an extended down functional affirmation can be done with the help of 3d Printing as well. 3D printing has just begun to explore the possibilities in Architecture.



Figure 1.11

VIII. ADVANTAGES OF 3D PRINTER

- Speed
- Single step manufacture
- Cost
- Risk mitigation.
- Complexity and design freedom.
- Customization.
- Ease of access.
- Sustainability.

IX. DISADVANTAGES OF 3D PRINTER

- High energy consumption.
- 3d printing technology is expensive.
- Limited materials.
- 3D printers are not that user-defined.
- Harmful emissions.
- Too much reliance on plastic.
- 3D printers are slow.
- Manufacturing job losses.

X. CONCLUSION

3D printing is no more a complicated it is spreading widely in a variety of applications from simple domestic use to convoluted industrial applications with decreasing cost and increasing adaptability. Some experts argue that these printers will be the drive of a coming innovation that will change the whole face of industry, and that it will be a basic part of every home in conformance with the decrease in cost.

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