3D Printing Course for Beginners (Lecture-2)

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SCOPES

Overview of a 3D printing Process

A

1) Producing a 3D file
2) Stl creation and file manipulation
3) Printing
4) Removal of Prints
5) Post Processing

3D printing technology & Materials

B

Material extrusion — FFF

C

3D Printing Material Groups

D

3D printing technology & Materials

Section 1: Introduction

1. What is Additive manufacturing
2. History of 3D printing
3. Overview of 3D printing process

1) Producing a 3D file
2) Stl creation and file manipulation
3) Printing
4) Removal of Prints
5) Post Processing

Section 2: 3D printing technology & Materials

1. Classification of 3D printing technologies
2. 3D Printing Material Groups
3. Material extrusion — FFF
    1. Fused Filament Fabrication (FFF)
4. Vat polymerization technologies
    1. Stereolithography (SLA)

Section 3: Designing for 3D printing

a. General design considerations for 3D printing
b. Description of 3D printed features
c. Designing for Material Extrusion/FDM
d. Designing for SLA/DLP

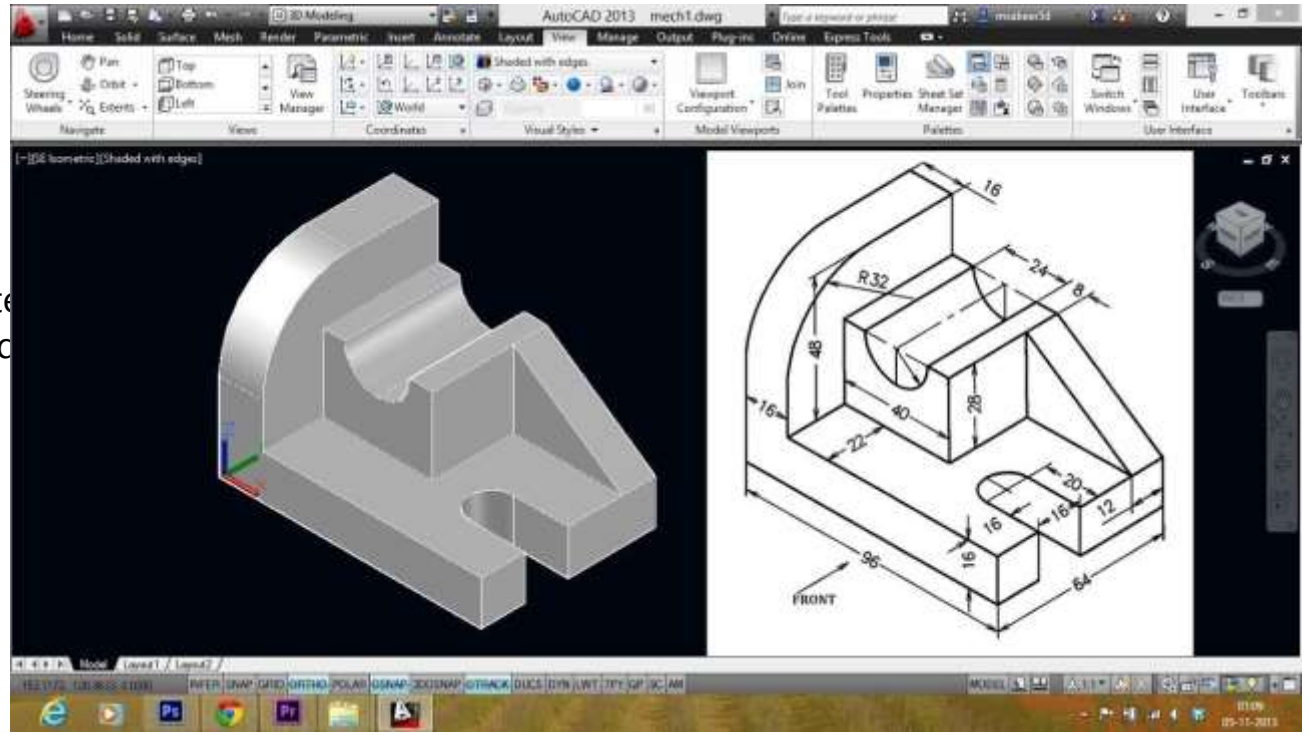
Section 4: Application of 3D Printing

a. Tools for producing 3D designs
b. Applications of Material Extrusion/FDM
c. Applications of SLA/DLP

Overview of a 3D printing Process

1. Producing a 3D file

   Producing a digital model is the first step in the 3D printing process. The most common method for producing a digital model is Computer Aided Design (CAD). Reverse engineering can also be used to generate a digital model via 3D scanning. Both CAD modeling and reverse engineering are going to be discussed in this course. There are several design considerations that must be evaluated when designing for 3D printing. These generally focus on feature geometry limitations, support material and escape hole requirements. Designing parts for 3D printing is discussed in Part 3 of this course.



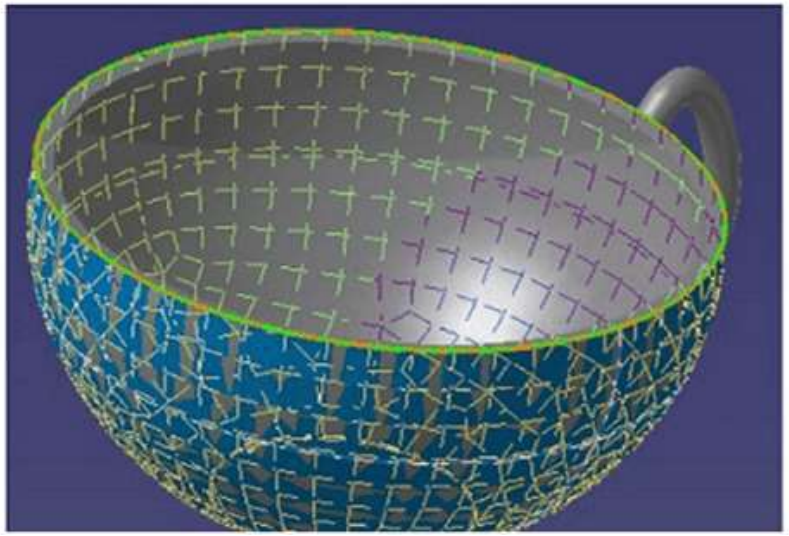
Overview of a 3D printing Process

2. STL creation and file manipulation

In order to 3D print a part, a CAD model must be converted into a format that a 3D printer is able to interpret. This begins by converting the CAD model into a Stereo Lithography (STL) file, also referred to as Standard Triangle Language file. OBJ or 3DP are also acceptable types of 3D printing file types but are less common. STL uses triangles (polygons) to describe the surfaces of an object, essentially simplifying the often complex CAD model. Most CAD programs are capable of exporting a model as an STL file.

Once a STL file has been generated, the file is imported into a slicer program, which slices the design into the layers that will be used to build up the part. The slicer program takes the STL file and converts it into G-code. G-code is a numerical control programming language used in CAM to control automated machines like CNC machines and 3D printers.

The slicer program also allows the 3D printer operator to define the 3D printer build parameters by specifying support location, layer height, and part orientation. Slicer programs are often proprietary to each brand of 3D printer, although there are some universal slicer programs like Netfabb, Simplify3D and Slic3r.



Overview of a 3D printing Process

3. **Printing**

Each of the 3D printing technologies discussed in this book additively manufacture parts differently. A detailed explanation on how each 3D printing technology produces parts, as well as the materials associated with each, are presented in this course.

4. **Removal of prints**

For some 3D printing technologies, removal of the print is as simple asseparating the printed part from the build platform (Figure 0.6). For other more industrial 3D printing methods, the removal of a print is a

highly technical process involving precise extraction of the print whileit is still encased in the build material or attached to the build plate.
These methods generally also require strict removal procedures andhighly skilled machine operators along with safety equipment and controlled environments.

Overview of a 3D printing Process

5. Post processing

Post processing procedures again vary by printer technology. Some technologies requires a component to cure under UV before handling while others allow parts to be handled right away. For technologies that utilize support, this is also removed at the post processing stage

The best way to determine whether a certain method of 3D printing is suitable for an application is to understand the mechanisms behind how the technology produces parts. Part 1 of this book aims to answer this question by introducing the most common methods of 3D printing and how each of them additively manufacture parts

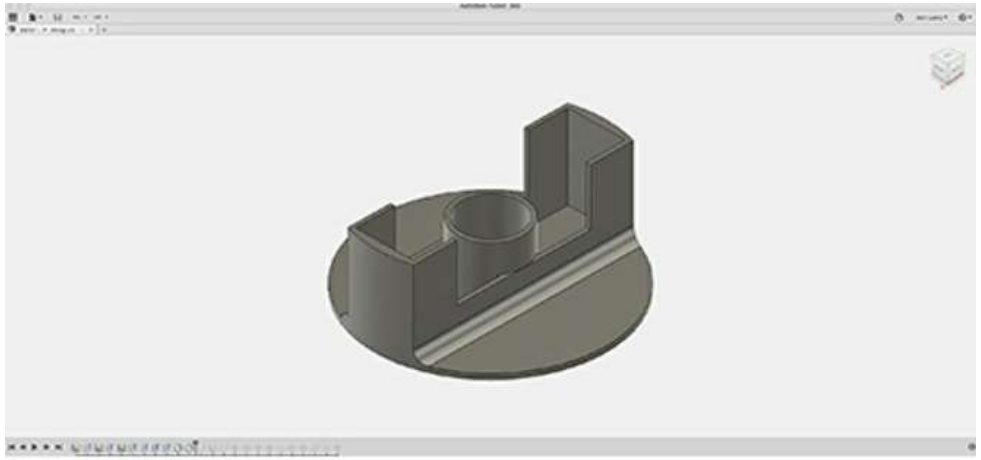
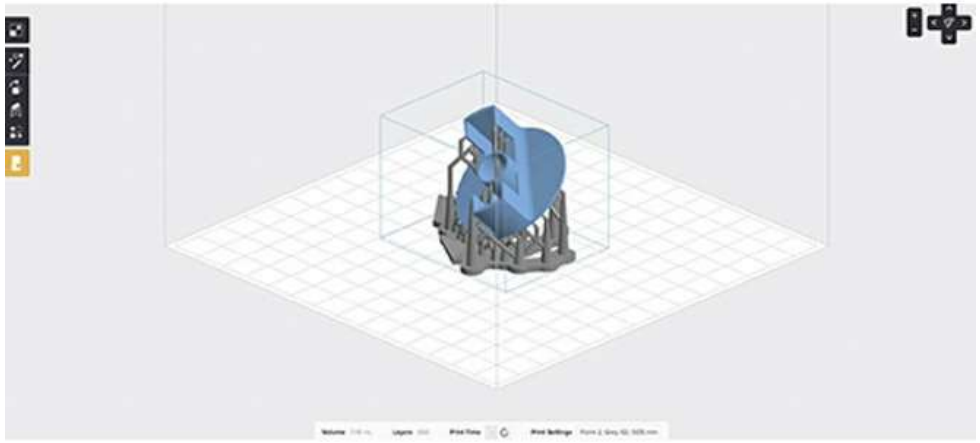
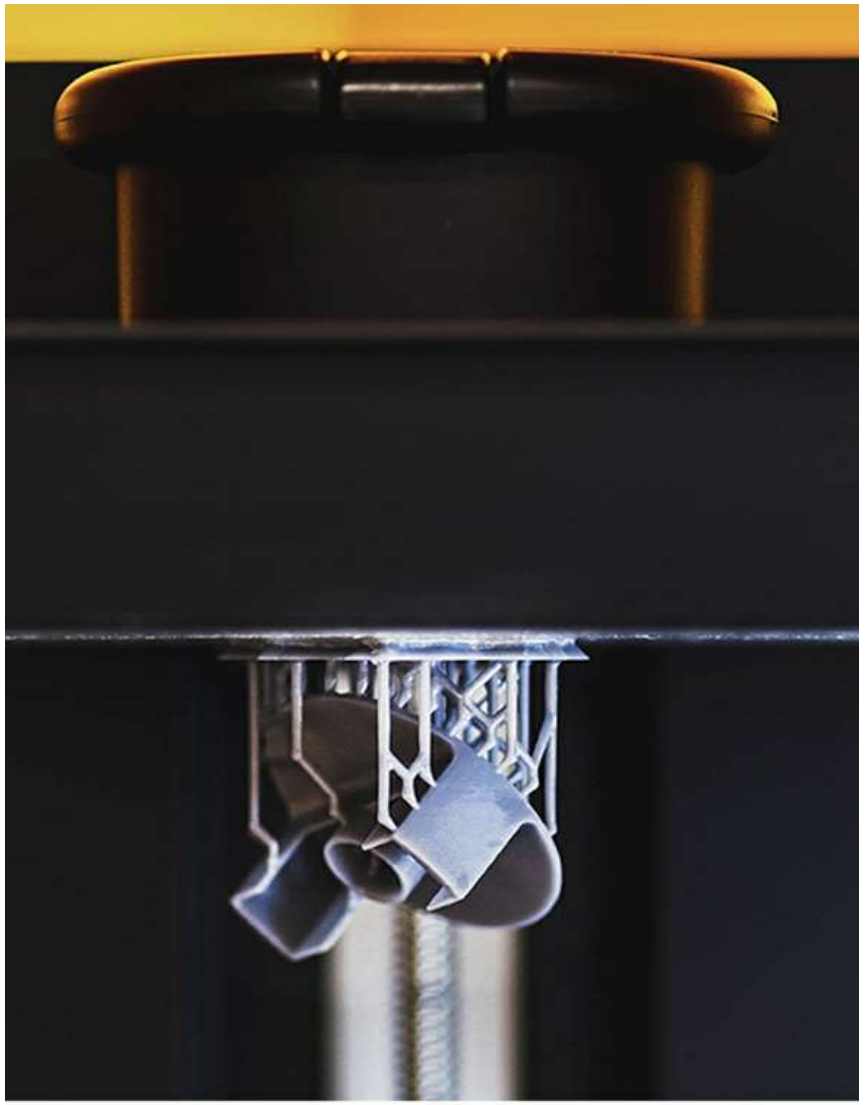


Figure 0.3 – A 3D CAD model of a shaft end cap produced in Autodesk Fusion 360. An STL file can be exported from the CAD program. The diameter of the cap is 40 mm



Importing the STL file into the Formlabs slicing program Preform. The slicing programs allow for the shaft end caps' orientation to be defined as well as where support material is located

Overview of a 3D printing Process



The finished shaft end cap on the Formlabs Form 2 before being removed from the build platform. Print time for the motor housing cap was approximately 1.5 hours

The shaft end cap after being removed from the build platform with support structures still attached

The finished shaft end cap with support structures removed

Q/A

THANK YOU