

Digital Material Culture

3D Printing Workshop

2023-2024

-

tutorial 1

Introduction to 3D printing

Break

Tutorial 1
FDM 3D Printing A-Z
Classroom

Break

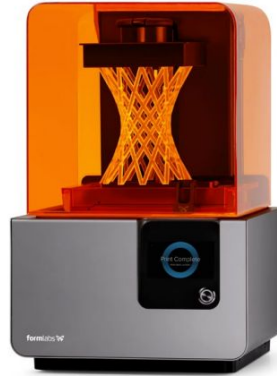
Tutorial 1
FDM 3D Printing A-Z
Demo on the printer

Break

Class work time and instructions

3D Printing Technologies

1. SLA - Stereolithography
2. SLS - Selective laser sintering
3. FDM - Fused deposition modeling
4. SLM - Selective laser melting
5. EBM - Electron beam melting
6. PolyJet - Type of material jetting



FORMLABS FORM 2
SLA 3D PRINTER



Sintratec SLS 3D PRINTER



Prusa i3
FDM 3D PRINTER



H3D SLM 3D PRINTER



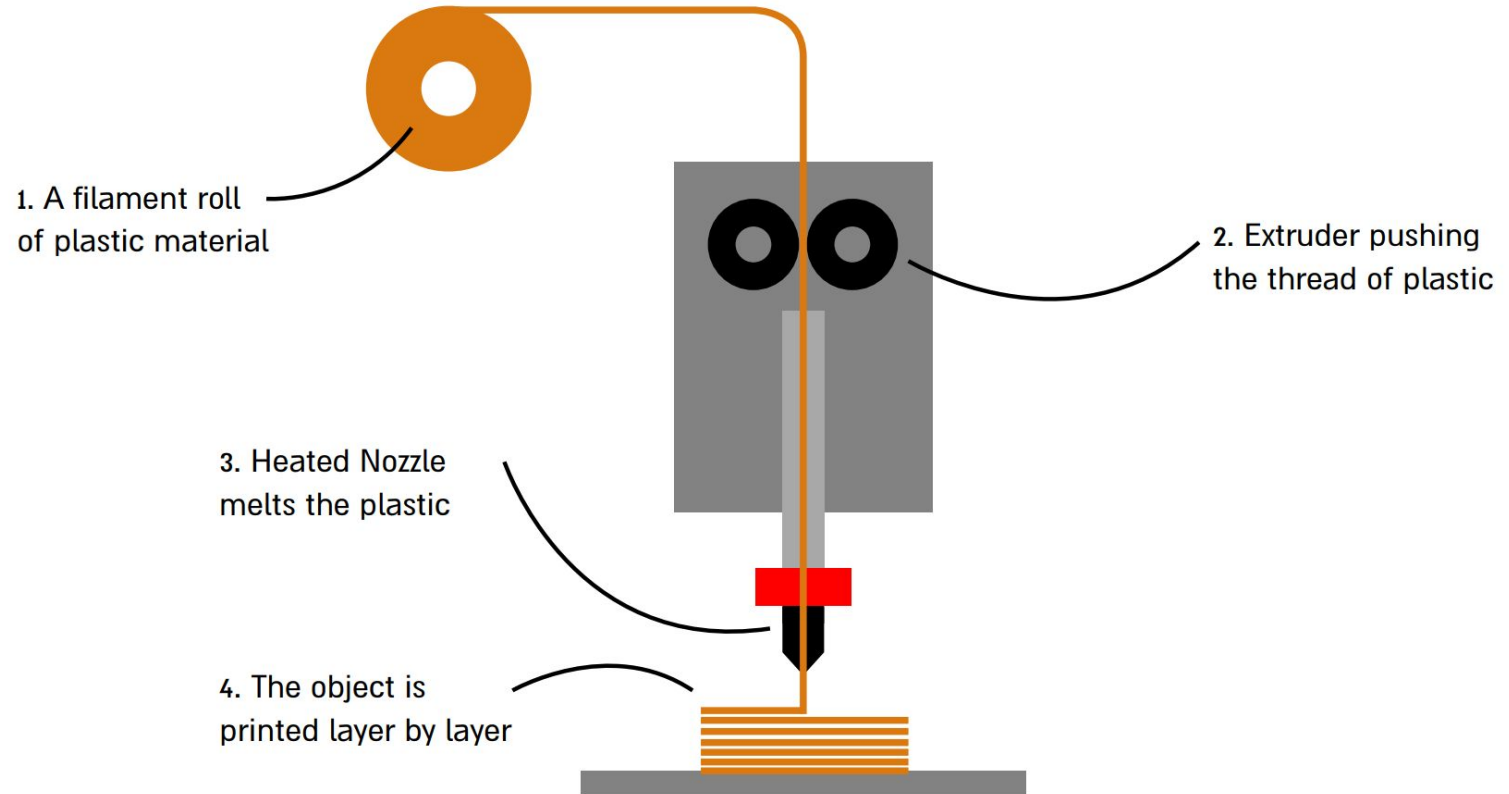
ARCAM Q10 EBM 3D PRINTER



stratasys j55
PolyJet 3D PRINTER

FDM 3D Printing

Fused Deposition Modeling



FDM 3D Printing Materials



PLA החומר הכי נפוץ, קל
להדפיס ולא מזיק

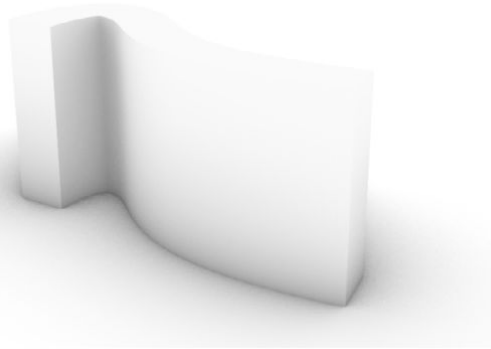
ABS קשה להדפיס, רעיל.
היתרון - ניתן להחליק
באמצעות אציטון

TPU פלסטיק גמיש - גומי.
יחסית קשה להדפסה

טווח מחירים: 80-120 שקל לקילו.

PLA | ABS | TPU | NAYLON | ASA | TPE

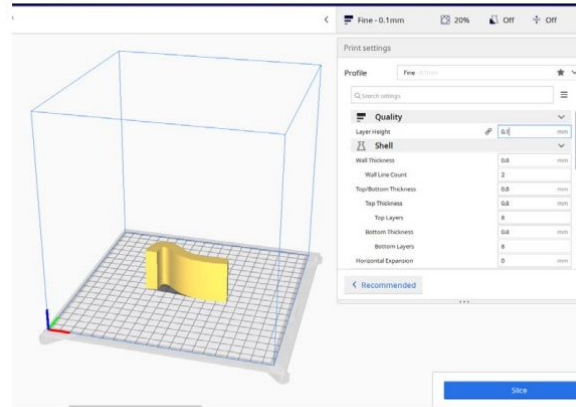
From 3D Model to Printed Object



Create a 3D Model- One closed solid



Export as an
STL file



Slicer- Software for preparing
files for printing



Gcode

```
FLAVOR:Marlin;  
TIME:10770;  
Filament used: 6.12494m;  
Layer height: 0.1;  
MINX:56.409;  
MINY:81.517;  
MINZ:0.3;  
MAXX:143.579;  
MAXY:118.48;  
MAXZ:39.9;  
Generated with Cura_SteamEngine 4.8.0;  
M140 S60  
M105  
M190 S60  
M104 S210  
M105  
M109 S210  
M82 ;absolute extrusion mode  
G21 ;metric values  
G90 ;absolute positioning  
M82 ;set extruder to absolute mode  
M107 ;start with the fan off  
G28 X0 Y0 ;move X/Y to min endstops  
G28 Z0 ;move Z to min endstops  
G1 Z15.0 F9000 ;move the platform down 15mm  
G92 E0 ;zero the extruded length  
G1 F200 E3 ;extrude 3mm of feed stock  
G92 E0 ;zero the extruded length again  
G1 F9000  
Put printing message on LCD screen/  
...M117 Printing  
G92 E0  
G92 E0  
G1 F1500 E-6.5  
LAYER_COUNT:397;  
LAYER:0;  
M107
```

Print



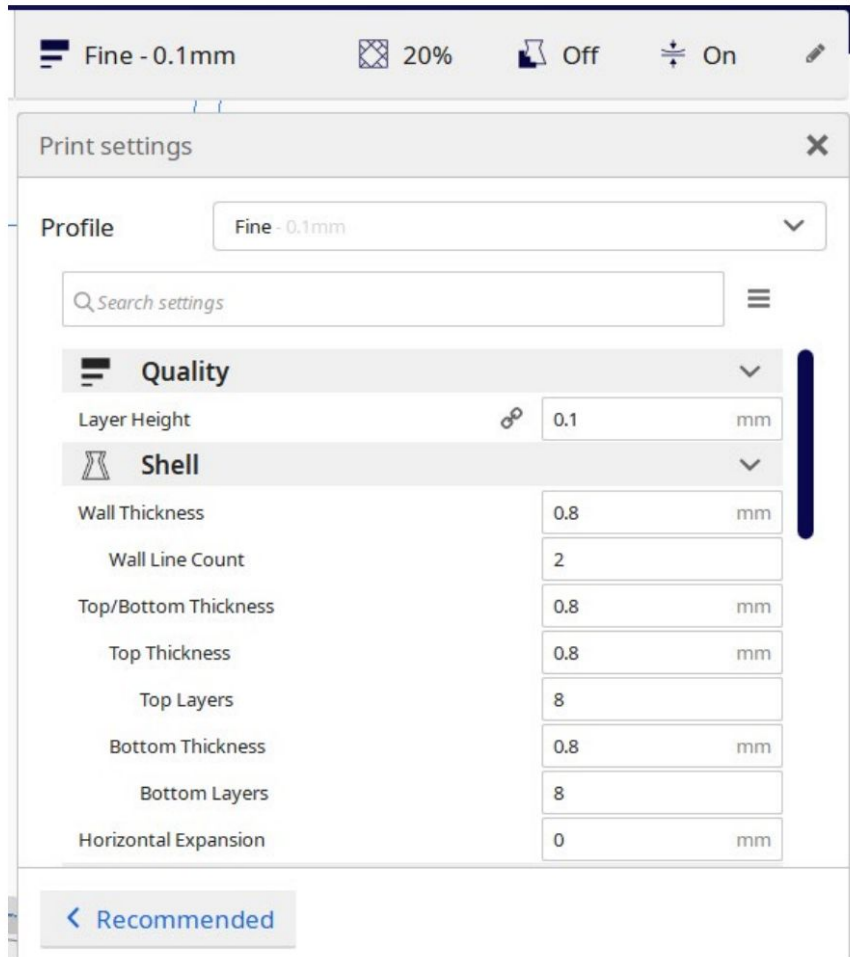
Parameters

- * Design
- * Printer
- * Material
- * Layer height
- * Nozzel temperature
- * Bed temperature
- * Speed
- * Leveling of printing bed
- * Feed rate
- * Infiil geometry and density
- * Supports - shape and density
- * Retraction
- * Build plate adhesion

These parameters and more affect the quality and visibility of the print

LINKS AND TUTORIALS FOR CURA

[Downloading CURA](#)
[CURA TUTORIAL](#)



Add Printer - The printers that we will use

Ultimaker S5 Generic AA 0.4

Preset printers

- Creality CR-10
- Creality Ender-3 Pro
- Prusa i3
- Ultimaker S5

Add printer **Manage printers**

Prusa i3

Ultimaker S5

Add Printer

Add a printer

Add a networked printer

Add a non-networked printer

Prusa i3

Manufacturer Prusa3D
Profile author Quillford
Printer name

Cancel **Add**

Add Printer

Add a printer

Add a networked printer

Add a non-networked printer

Ultimaker S5

Manufacturer Ultimaker B.V.
Profile author Ultimaker
Printer name

Cancel **Add**

Layer Height

The layer height sets the print resolution

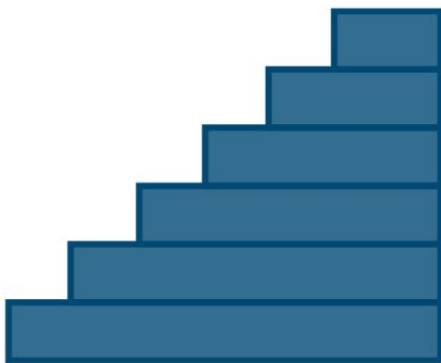
Tall layers = low resolution - fast print

Short layers = high resolution - slow print

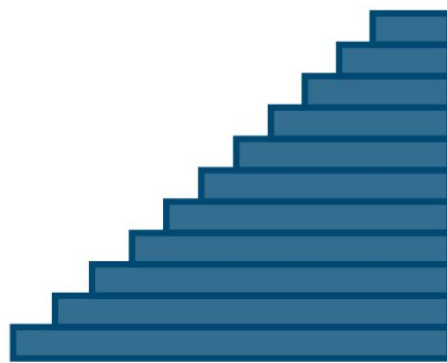
Each printer has a different range of layer heights



.STL File



Tall Layer Height



Short Layer Height

Infill

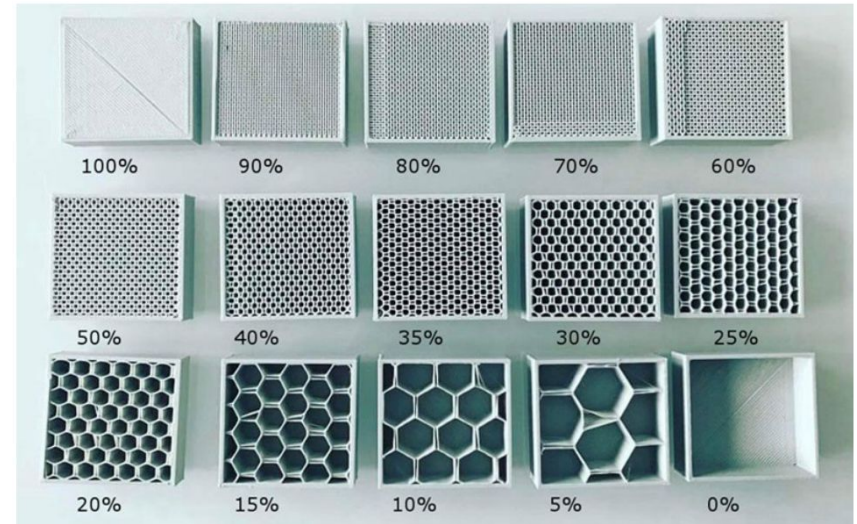
Usually, we will not print an object as 100% solid.

The infill patterns and density will determine the strength of the print, the amount of material and the printing time.

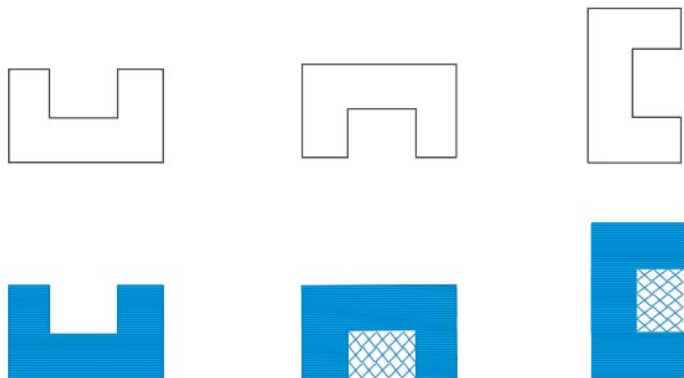
A high percentage of Infill= stronger print, more material and more time

A low percentage of Infill= weaker print, less material and less time.

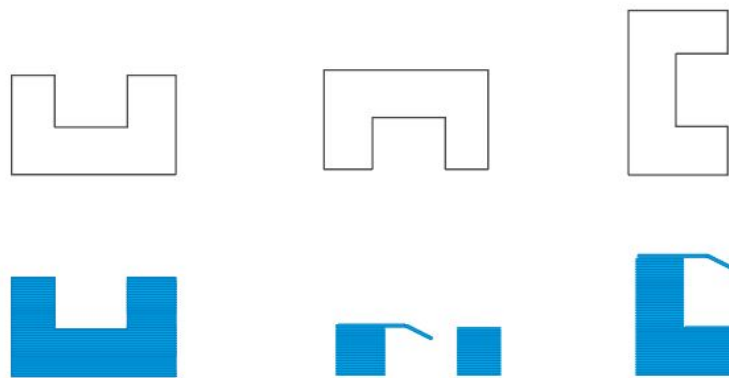
[Cura Guide to the Best Infill Patterns](#)



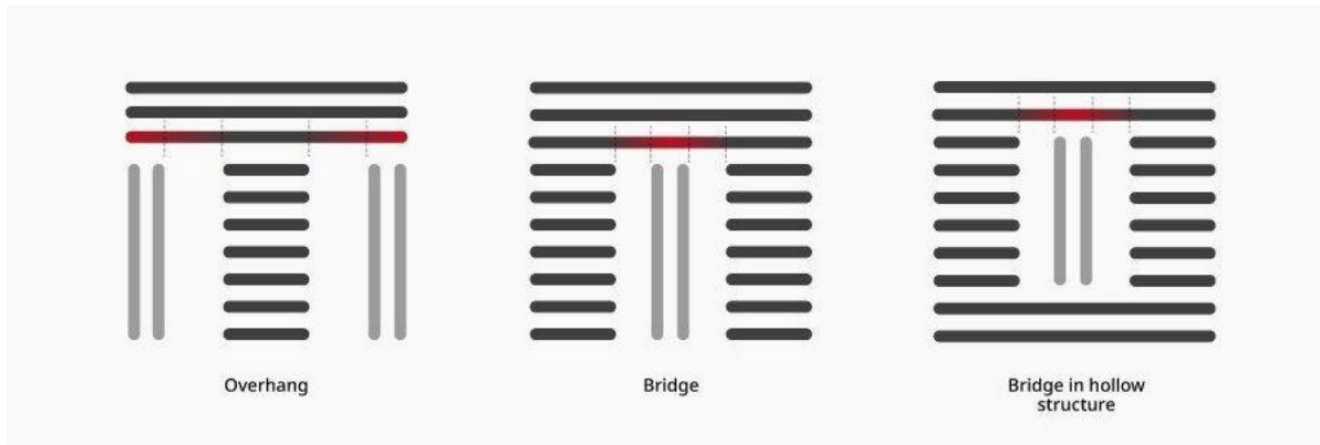
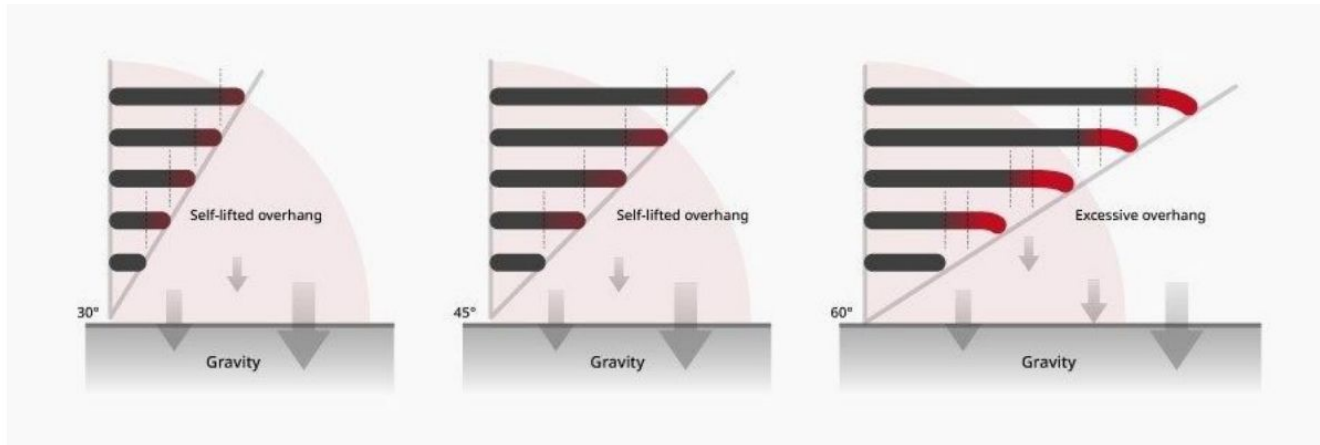
Bridges, support, and limitations



גשרים, תמיכות (Support) ומגבלות



support



Bridges, support, and limitations

גשרים, תמיכות (Support) ומגבלות



28.6% waste
4h36m



27.5% waste
4h01m



6.6% waste
3h16m

Printing test files



קבצי עזר לכיול הגדרות

#3DBenchy - The jolly 3D printing torture-test

הורדה ואתר מצחיק - [Download file](#)

הסבר - [How it can help](#)

מגדל טמפרטורה | [temperature towers](#)

הסבר והוראות בעברית

אתר המבחנים הגדול | [3D Printer Calibration](#)

הסבר | [How it works](#)

עוד קבצים ממולצים לטסטים:

[קוביית XYZ](#) | [טסט כולל](#) | [בדיקת רווח לתנועה](#)

[3D Printing Troubleshooting Common Problems](#)



Useful links

[הורדת CURA](#)

קבצים מוכנים להדפסה:

1. [thingiverse](#)

2. [myminifactory](#)

מדריכים שימושיים:

1. [Cura - Tutorial for Beginners](#)

2. [Cura - Tutorial for Beginners 2](#)

3. [Best Cura Infill Pattern \(for Your Needs\)](#)

4. [ערוץ יוטיוב נחמד \(בעברית!\) עם הדרכות, עצות והסברים בסיסיים](#)

מדריכים יותר מתקדמים:

1. [G-code Explained | List of Most Important G-code Commands](#)

2. [G-CODE instructions](#) - חוברת הסבר על כל הפקודות בG-CODE

דברים נחמדים:

1. [Make Anything](#) - ערוץ יוטיוב עם הדפסות מגניבות

2. [CHEF](#) ערוץ יוטיוב עם הדרכות טובות