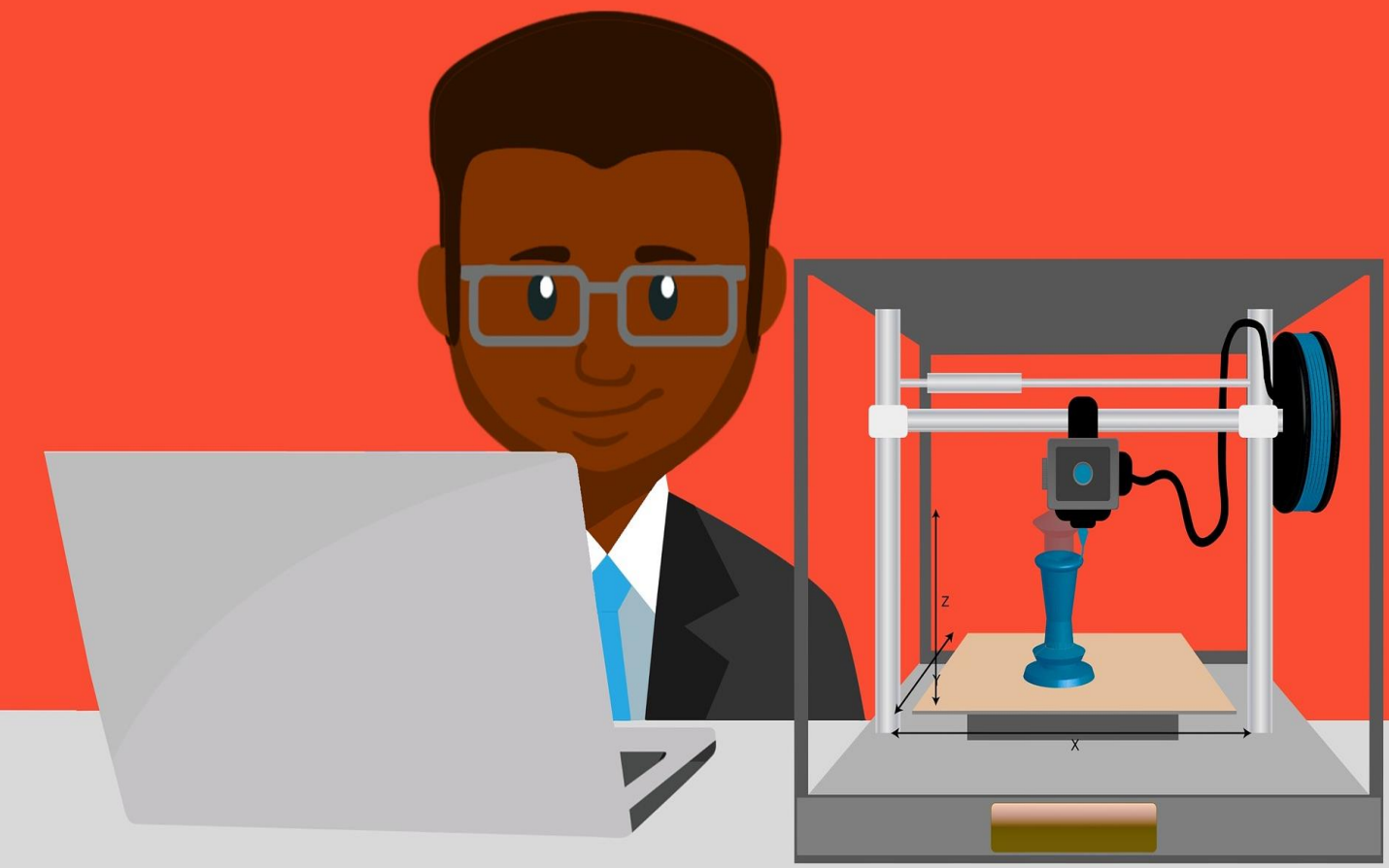
How to choose the best technology for your prototype



3D printing and more!

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Introduction

Rapid prototyping technologies are processes that involve the use of digital CAD models for the creation of physical objects.

To choose the most suitable technology for your project, it is important to clarify the purpose of the prototype: the function it must have, which tests it must undergo, the quality of the aesthetic surfaces, the environmental and thermal context, any contact with liquids or elements. external and anything else that can be useful in the feasibility study phase.

In this e-book you will find the technologies most used in the manufacturing industry that has always used rapid prototyping and manufacturing to validate the engineering of its product, to bring it to the fair or to distribute it to its sales force.

We have also specifically included traditional processes and technologies widely used in industry for needs that cannot be met by 3D printing.

Introduction

This trend has emerged for two main reasons:

- There are technologies with which it is possible to make products and components that are almost identical to mass production By creating a pre-series it is possible, with a limited investment, to commercially test the product and postpone investments on series production by first collecting feedback from your market through your sales network or at the fair.
- In this way it is also possible to make changes or customizations to the project requested by customers (where possible) before moving on to the series

There is no better technology than the other; the important thing is to identify the prototyping methods that best fit my project and the different phases that make it up.

This guide will help you to get an overview of the different existing technologies, the different characteristics and the advantages and disadvantages of each technology. All to give you the opportunity to better orient yourself in your choice

Technologies for the manufacturing industry

Acronym	Technology	Process	Tolerances	Materials
SLA	Stereolithography	Additive layers for photopolymerization	±0,1 mm	Thermoplastic photopolymers
DLP	Stereolithography LCD	Additive layers for photopolymerization	From ±0,05 to ±0,15 mm	Thermoplastic photopolymers
SLS	Selective laser sintering	Additive layers for laser sintering	±0,2 mm	PA powder
FDM	Fused deposition modelling	Additive layers for cast extrusions	From ±0,127 to ±0,330 mm	ABS, PC, PC/ABS, PPSU
HP MJF	HP - Multi Jet Fusion	Additive layers for laser sintering	±0,2 mm	PA powder
RPL	Silicone Replicas	Vacuum Casting	From ±0,051 to ±0,152 mm	Rigid and semi-rigid resins and rubbers, also co-molded
CNC	CNC machining	Surface milled with subtractive technique;	±0,05 mm	Common and industrial thermoplastics / metals
DMLS	Direct Metal Laser Sintering	Additive layers for metal laser sintering	±0,05 mm	Metals
LCM	Lithography-based Ceramic Manufacturing	Additive layers for photopolymerization	±0,2 mm	Aluminia, Zirconia, Silica and Hydroxyapatite

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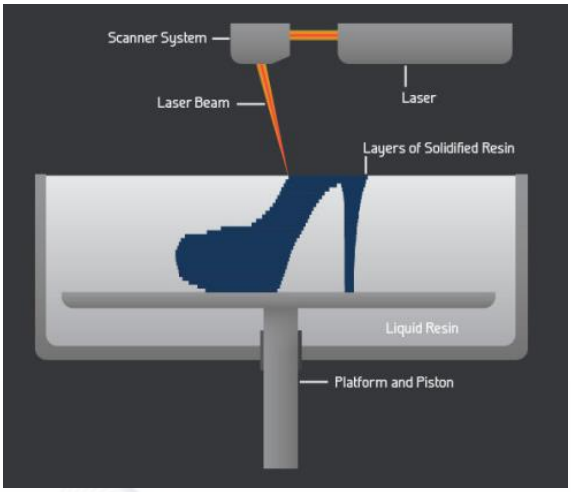
SLA: Stereolithography

Acronym	Technology	Process	Tolerances	Materials
SLA	Stereolithography	Additive layers for photopolymerization	±0,152 mm	Thermoplastic photopolymers

Stereolithography is based on the polymerization of a liquid by the effect of a laser. The process starts with the creation of supports necessary for the construction of the piece.

This technology is widely used for aesthetic prototypes, to produce very precise prototypes and as a master for pre-series from silicone molds.



Pros

- Excellent surface finish (the best of the technologies in comparison). Suitable for surface treatments such as painting, metallization, screen printing.
- High resolution and high precision
- Ability to produce complex geometries
- Good resistance to liquid absorption

Cons

- Lower mechanical strength than SLS / CNC
- Resin can become brittle over time

Stereolithography _LCD

Acronym	Technology	Process	Tolerance	Materials
DLP	Stereolithography LCD	Additive layers for photopolymerization	From ±0,051 to ±0,152 mm	Thermoplastic photopolymers

LCD stereolithography is based on the polymerization of a liquid by the effect of a projector.

The machines have a small working area so it is a useful technology when it is necessary to produce small and very precise prototypes for example in the dental sector.

Pros

- Excellent surface finish (the best of the technologies in comparison).
- High resolution and high precision up to ±0,05 mm
- Ability to produce complex geometries
- Good resistance to liquid absorption

Cons

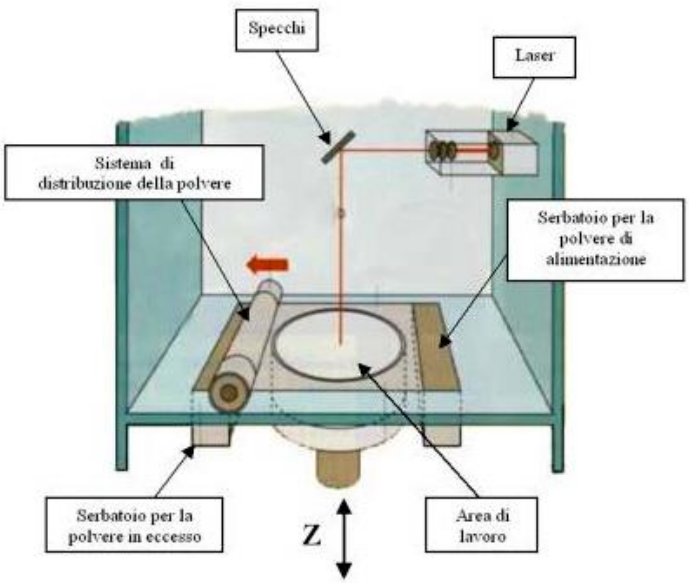
- Lower mechanical strength than SLS / CNC
- Resin can become brittle over time
- Small working area

SLS: Selective laser sintering

Acronym	Technology	Process	Tolerances	Materials
SLS	Selective laser sintering	Additive layers for laser sintering	±0,1 mm	PA powder also with glass or metal fibers

Selective laser sintering uses a laser to sinter thermoplastic powders. Nylon is a biocompatible material according to EN ISO 10993-1, is classified USP Level VI / 121 ° C and approved for contact with food.

The pieces have good chemical resistance and low moisture absorption.



Pros

- Higher mechanical strength than SLA
- Ability to produce complex geometries
- It is possible to load nylon with glass fiber, aluminum or ceramic

Cons

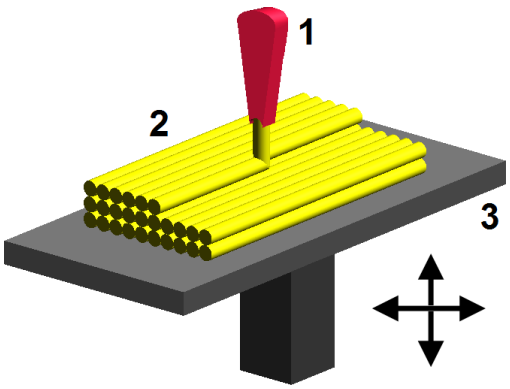
- Rough finish on the surface
- Difficult to treat superficially (painting etc.)
- The material absorbs moisture

FDM: Fused Deposition Modeling

Acronym	Technology	Process	Tolerances	Materials
FDM	Fused deposition modelling	Additive layers for cast extrusions	From ±0,127 to ±0,330 mm	ABS, PC, PC/ABS, PPSU

Fused Deposition Modeling (FDM) is an additive technology that releases material in layers.

A filament of thermoplastic or metallic material is deposited on a tray through a nozzle that heats the material.



Pros

- Reproduction of the characteristics of ABS, PC or Ultem

Cons

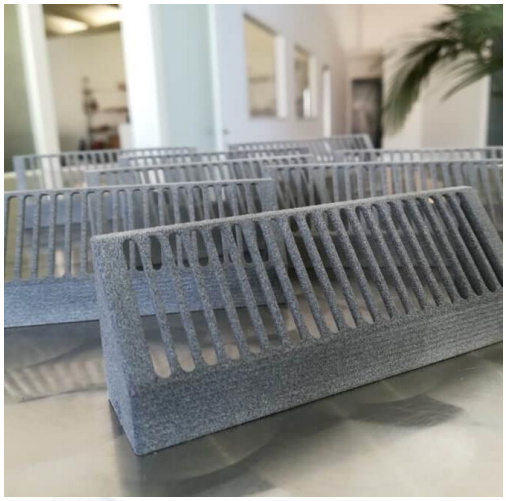
- The definition is determined by the nozzle exit hole; this is why the surface often has steps

HP: Multi Jet Fusion

Acronym	Technology	Process	Tolerance	Materials
HP MJF	HP – Multi Jet Fusion	Additive layers for laser sintering	±0,2 mm	PA powder also with glass or metal fibers

HP's MJF Multi Jet Fusion technology uses PA 12 and is characterized by 175 ° C heat resistance, waterproofing of prototypes and good mechanical properties

The performance of the models is particularly suitable for functional tests.



Pros

- Often cheaper than SLS
- Waterproof
- Good mechanical and thermal resistance

Cons

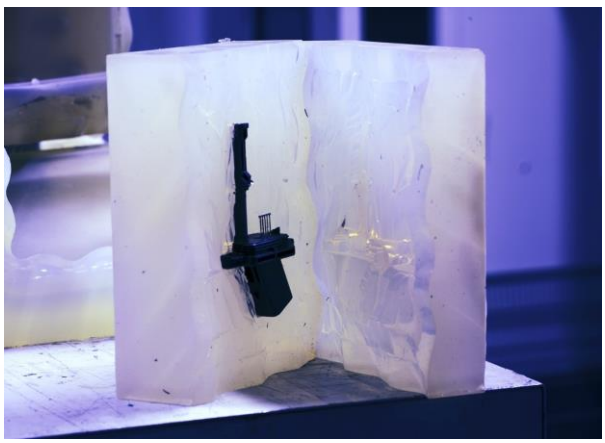
- Rough finish on the surface
- Difficult to treat on the surface (painting etc.)

RPL: Vacuum casting

Acronym	Technology	Process	Tolerances	Materials
RPL	Silicone mold replicas	Vacuum casting	±0,1 mm	Rigid, semi-rigid polyurethane resins. Rubbers, also co-molded

The vacuum casting process involves the construction of a silicone mold with an SLA master, each mold is suitable for the production of 25-30 pieces.

It is possible to produce co-molded pieces in rigid plastic rubber, or to place inserts inside the mold.



Pros

- Possibility to use the pieces on final machines
- Certified materials for use in the medical, aeronautical and automotive fields
- Excellent aesthetic and functional performance
- Rubbers from 30 to 90 shoreA

Cons

- It is necessary to build a mold whose cost is generally amortized within 5/6 castings

DMLS: Direct Metal Laser Sintering

Acronym	Technology	Process	Tolerance	Materials
DMLS	Additive layers for metal laser sintering	Additive layers for metal laser sintering	±0,05 mm	Metals

Direct laser sintering of metals (DMLS) is the leading additive manufacturing technology for making metal prototypes. The materials used are titanium alloys cobalt-chromium alloys, stainless steel and aluminum.

One of the best qualities of this printing technique is that the mechanical and physical properties of the object are practically identical to those of a model obtained by traditional casting.

Pros

- Discrete surface finish
- Mechanical properties comparable to production parts
- Possibility of creating complex geometries that cannot be produced with other traditional CNC machining

Cons

- High cost of materials
- It is necessary to mill the prototype after the process to eliminate the supports

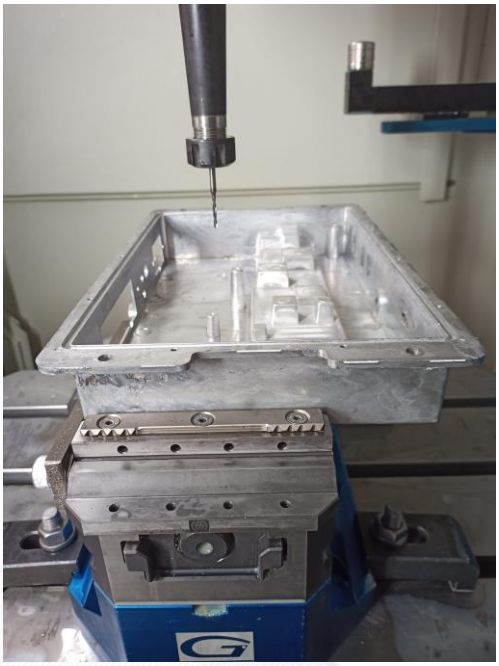
CNC: Computer Numerical Control

Acronym	Technology	Process	Tolerances	Materials
CNC	CNC machining	Surface milled with subtractive technique	±0,05 mm	Common and industrial thermoplastics / metals

The resistance and surface finish of the prototype are superior to any additive process as a solid block of definitive material is used.

Unlike additive technologies, this technology works by subtracting material.

The good tolerances make the pieces suitable for functional testing tests.



Pros

- Good surface finish
- Possibility to work indiscriminately with metals or thermoplastics

Cons

- Greater difficulty in making undercuts
- Higher cost than additive technologies

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IDEA & SVILUPPO Srl: Via Salita Cellini, 7 - 65125 - Pescara (PE) | P.IVA 01971530686 | Tel+39 0871 250230 | Fax+39 085 9112093
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