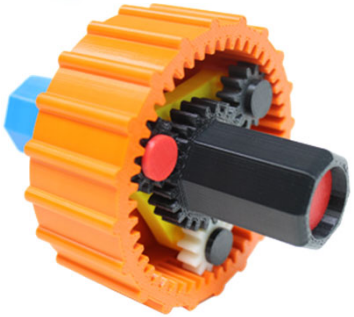
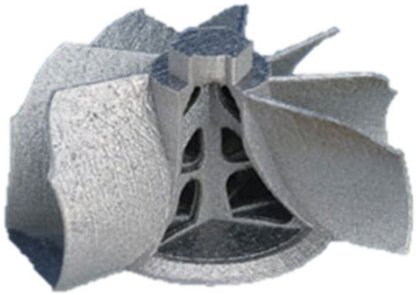
Lab of Rapid Prototyping (3CFU)

a.y. 18/19

Luana Bottini

Alberto Boschtto





Lesson 1

Introduction and course organization

General information

Lessons hours

Thursday 13.00 – 16.00 classroom 20
Friday 11.00 – 14.00 classroom 10

Exam

Written project
Oral presentation of the project

Contacts

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WEB site:

Information about the course are aviable on the web site:
http://www.ingmecc.uniroma1.it/users/cdsmecc/joomla2/index.php?option=com_course&view=course&id=326&Itemid=3512&lang=it

Aim of the Lab

Provide the theoretical and practical abilities to fabricate a functional component via Additive Manufacturing technologies

In particular cabability to:

- Manage, repair and process a 3D model
- Choose the process parameters taking into account the post-processing and the further secondary operations
- Spread among several secondary operations typical of AM technologies
- Predict the cost and time needed for the entire process

Useful courses

– Additive Manufacturing and production systems

OR

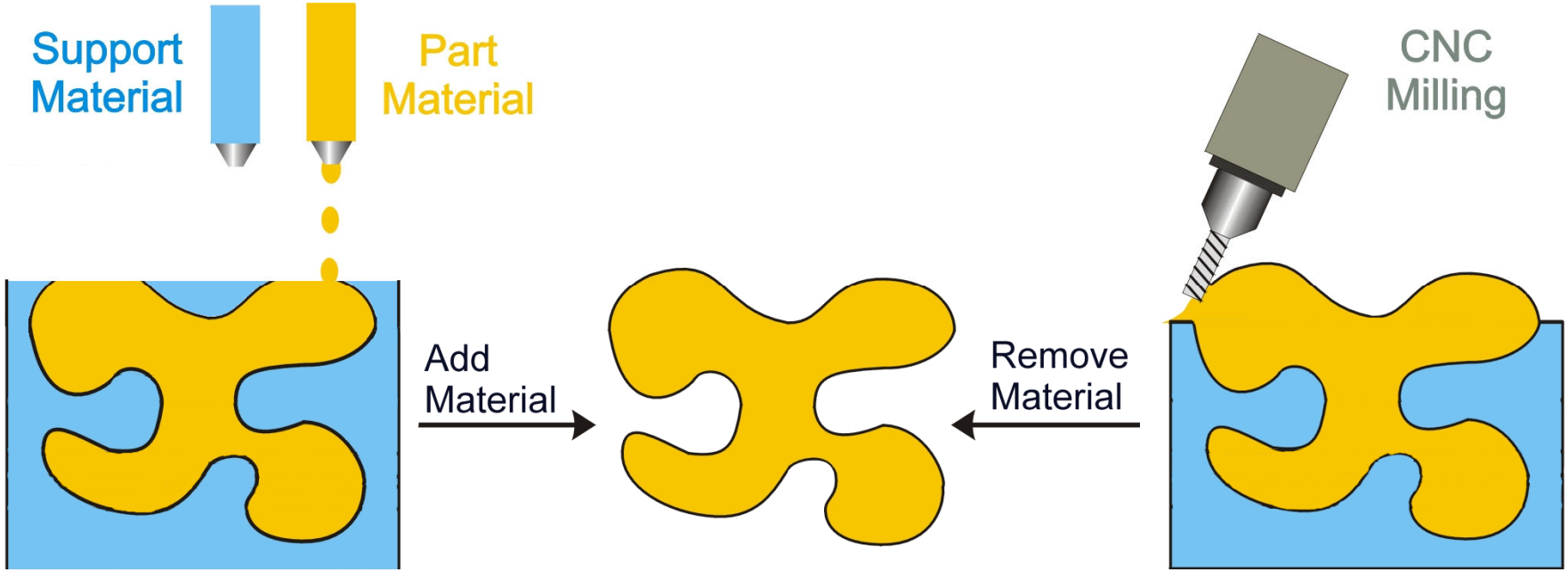
- Technologies and production systems

OR

-- Sistemi integrati di produzione

What is the Rapid Prototyping?

Technologies able to rapidly fabricate complex parts before final release and commercialization using both subtractive or additive technologies.



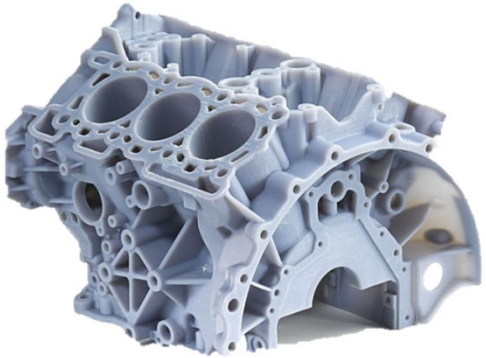
What is the Additive Manufacturing?

"…additive manufacturing is defined as the process of joining materials to make objects from 3D model data, usually layer upon layer, as opposed to subtractive manufacturing methodologies…"

Caffrey T, Wohlers T (2015) Wohlers Report 2015—Additive Manufacturing and 3D Printing State of the Industry—Annual Worldwide Progress Report.

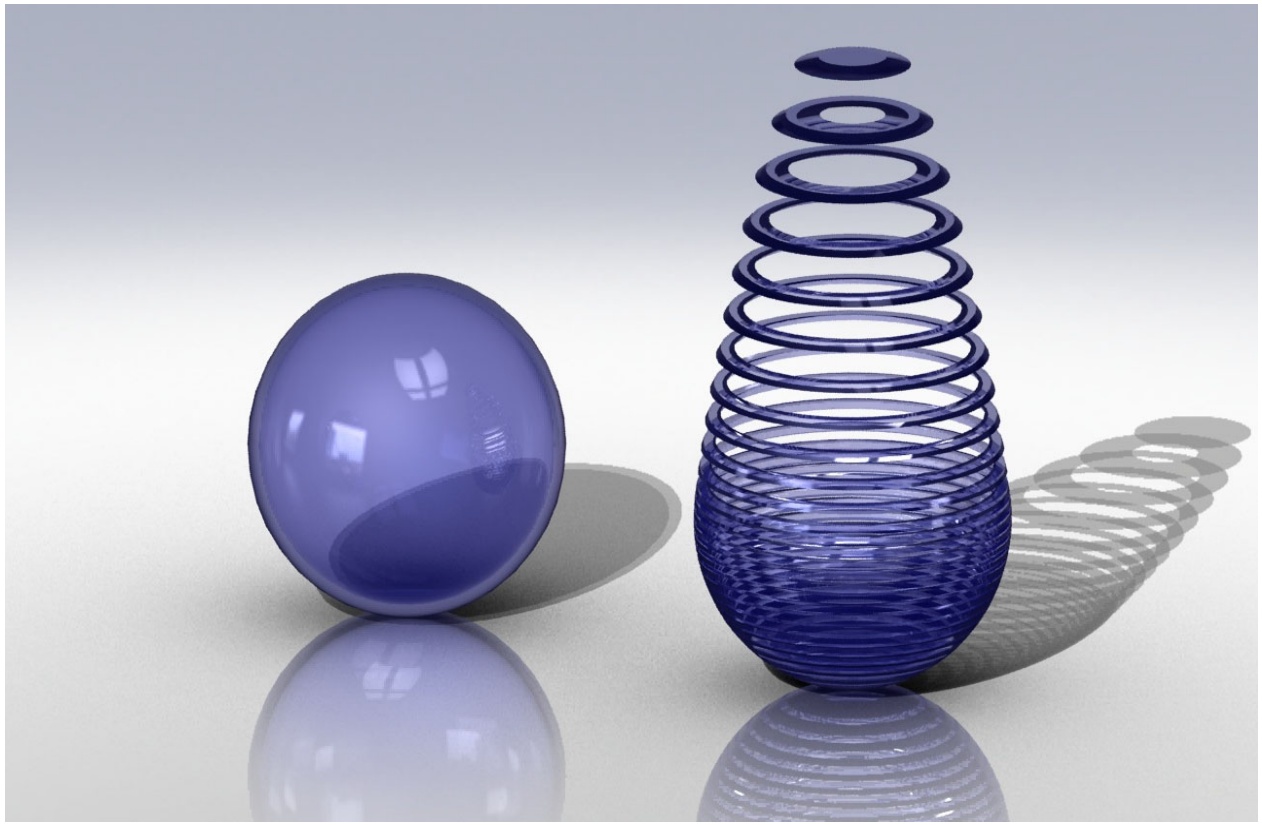
"Additive manufacturing is the general term for those technologies that based on a geometrical representation creates physical objects by successive addition of material, layer by layer. These technologies are presently used for various applications in engineering industry as well as other areas of society, such as medicine, education, architecture, cartography, toys and entertainment."

Astm 52900 (2015)

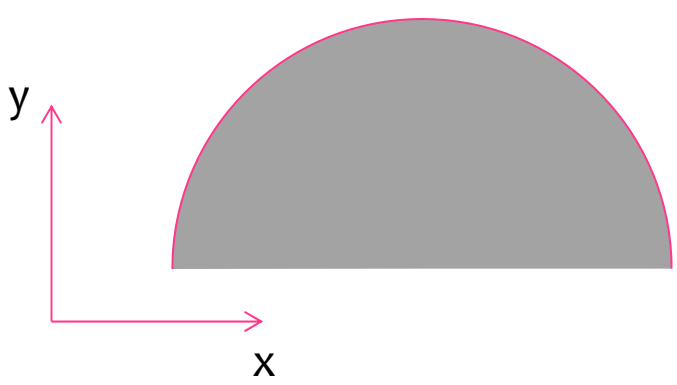


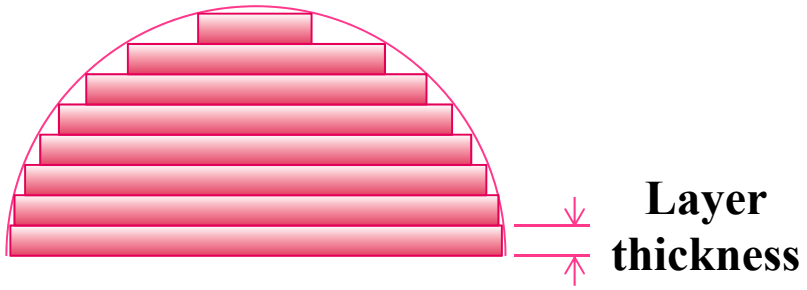
The idea…

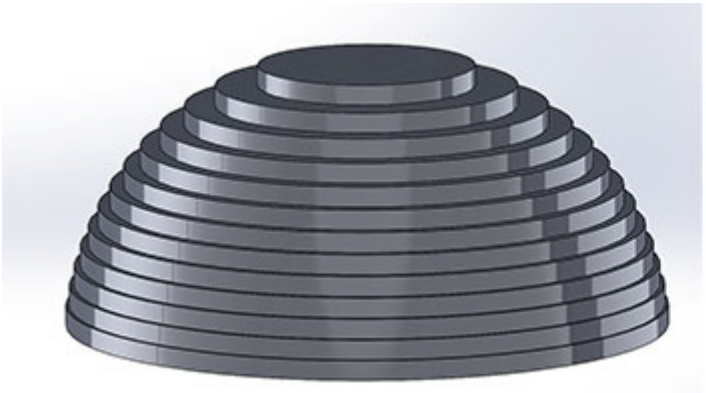
Every object, indipendently from its geoemtry, can be cut in fine parallel layers by planes perpendicular to the building direction. This operation and the single slice are called slicing and layer respectively. The layer thickness changes with the chosen AM technology.



Staircase effect: the inclined surfaces are characterized by a staircase effect that is intrinsic to the layer by layer fabrication. Greater is the layer thickness, larger is this effect that produces high roughness values and surface inaccuracies.

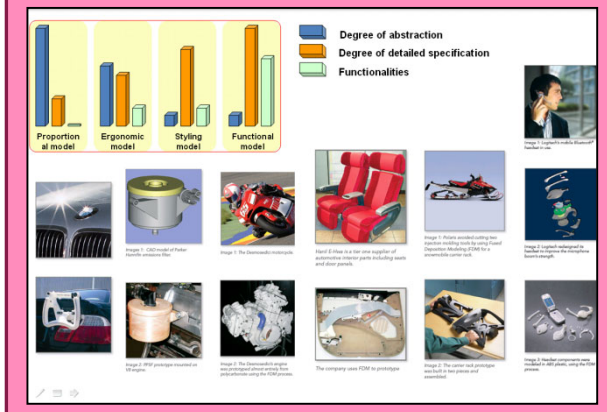






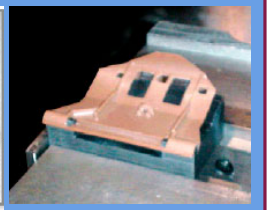
RP evolution

Rapid prototyping



Rapid Tooling




Rapid Manufacturing



Structure of the Lab course

- Theoretical lessons
- Laboratory visit
- Industrial seminar with an AM enterprise
- Development of a project; formation of groups of 4 or 5 students
- For each group:
  - Study of some AM technologies
  - Assignment of a component with some requirements (different for each group)
  - Design of the fabrication process of this component by different AM technologies
  - Preparation of a written report
  - If the report is accepted, presentation of the report.

Structure of the Lab course

Rules

- The group list must be provided **as soon as possible**.
- The report must be delivered by e-mail to the professor **at least 7 days before the date of the exam**. **Reports sent after this date will be considered for the next exam section;**
- After the correction of the report, the Professor can:
  - **Accept the report**. In this case the group can prepare the report presentation to discuss during the exam;
  - **Accept the report with a review**. The Professor suggests by e-mail some modifications to do. The revised report must be sent again before the discussion.
  - **Reject the report**. In this case the project must be developed again.
- Each component of the group must partecipate to the presentation;
- The presentation time must be of **about 15 minutes** and it will be followed by **some questions**. The discussion **must be sufficient** for each student of the group. If one or many students are not sufficient they must repeat the oral discussion.

Structure of the Report

- **Technical introduction** to the assigned AM technologies
- **Functional study** of the assigned component
- **AM fabrication study** of the component for each assigned technology:
  - Virtual model, geometrical features and their fabricability
  - Choice of the material
  - Choice of the machine
  - Choice of the process parameters (considering the requirements and the chosen machine)
  - Slicing operation
  - Support structures design
  - Preparation of the building table
  - Suggestion of opportune post processing operations
  - Estimation of times and costs
- **Technologies comparison**

Software

- Netfabb 2019

Students can have 3 years licence by creating an account at the link:

http://www.autodesk.com/education/free-software/netfabb

- Meshmixer

The free download is available at: http://www.meshmixer.com/