

# Analysi of the Fused Deposition Modelling (FDM) process

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# Supervisor of the Thesis



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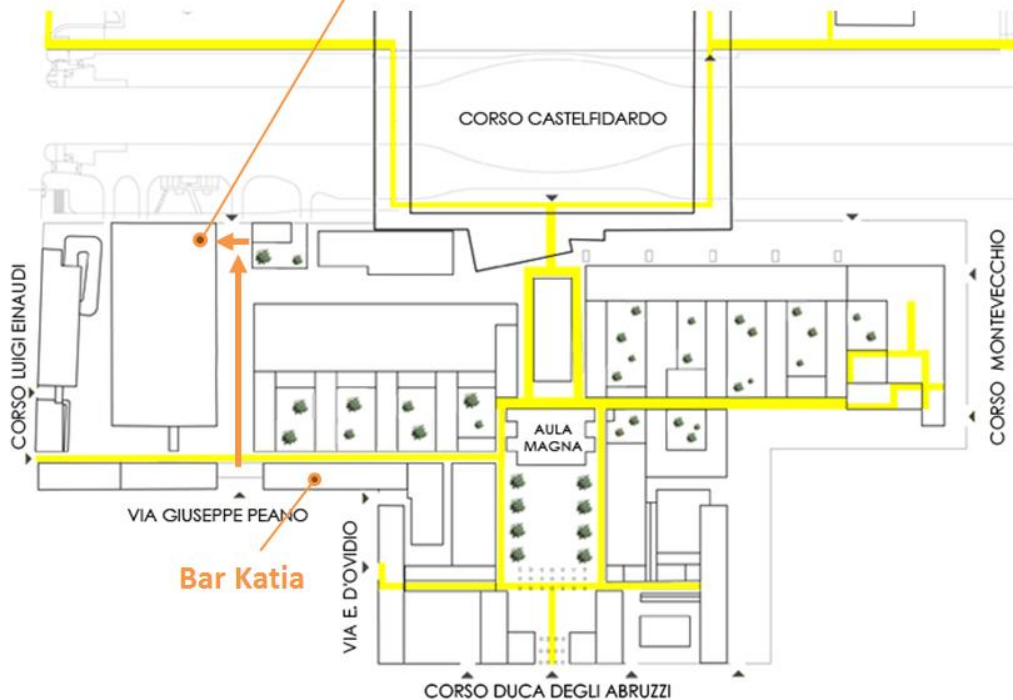
PhD. Production Systems Engineering



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# Topic

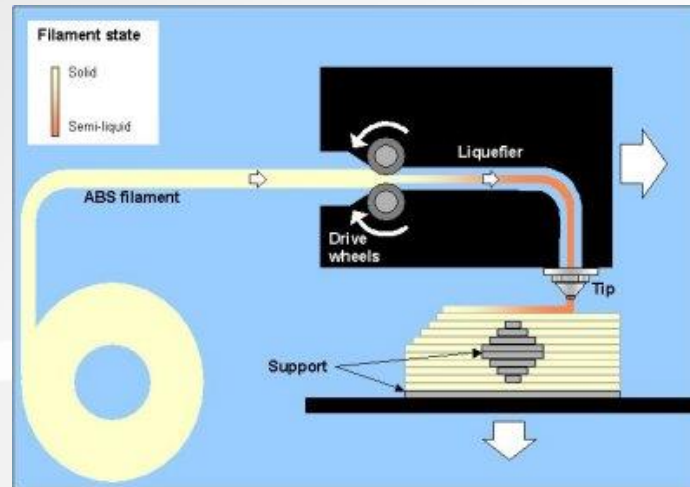
## The Fused Deposition Modelling (FDM) process in additive manufacturing

The Fused Deposition Modelling (FDM) process is an additive manufacturing technology that allows to fabricate plastic components by depositing layer by layer an extruded plastic wire on a building platform.

The FDM machines consist of an extruder head that melts the plastic wire. The trajectory of the extruder head is controlled by means of a numerical control code similar to that of machining centres .

The main advantage of additive manufacturing processes is the possibility to manufacture a part directly from its 3D CAD model without the need of any production tool (mould, die, fixtures, etc.).

The Advanced Manufacturing Technologies laboratory has recently bought an FDM whose NC code is open to be modified for investigation purposes about the use of different materials and the fabrication of different geometries through different deposition strategies.



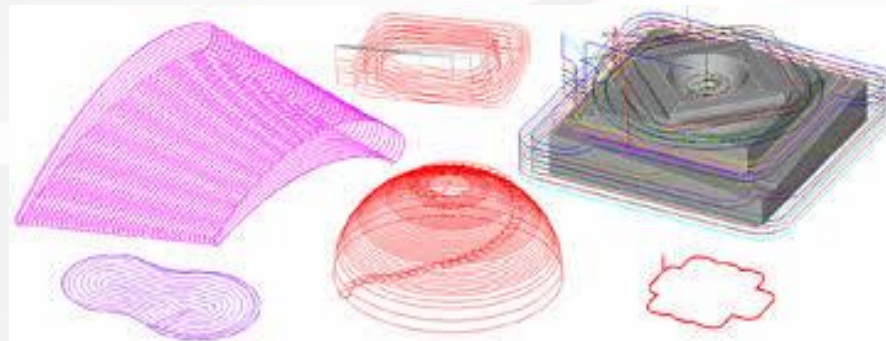
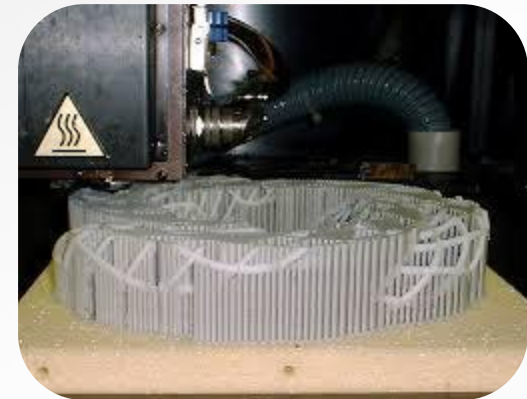
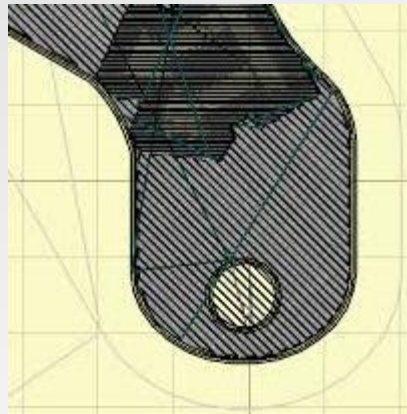
# The experimental activity

The research activity consists in writing the NC code in standard ISO format for programming the speed and the trajectories of the extruder head and also controlling the processing conditions (extrusion speed and temperature) of the material.

On one side such an activity is aimed at understanding the limits of the FDM process, but on the other side the process will be optimized according to the material used and to the geometry and required resistance of the built part.

Specimens and components will be inspected after fabrication to evaluate the dimensional accuracy of the FDM process.

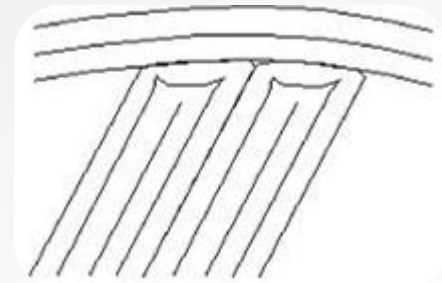
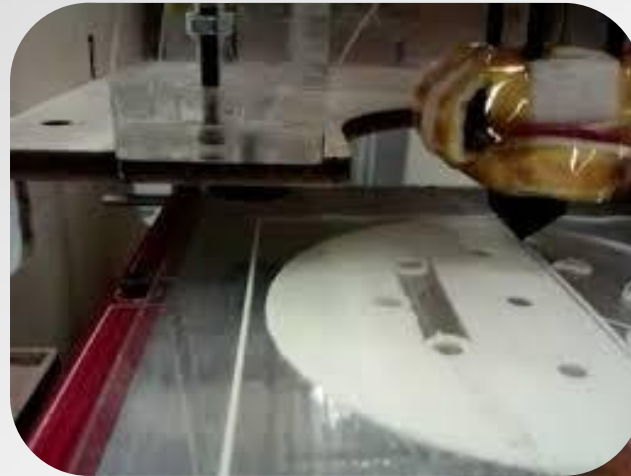
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^Checksum: YES
^Time: 1234
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^Ex2: PLA green
^Ex3: PLA black
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M105
M113 S1.0
M108 S600.0
M542
M107
M104 S260
M106
M551 P64000 S600
M543
M107
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M101
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G1 X0.0 Y6.975 Z0.7 F960.0
G1 X0.0 Y23.025 Z0.7 F960.0
```



# Results

The experimental activity aims at optimizing the FDM process for different plastic materials. Several parameters and aspects will be considered:

- Extrusion temperature
- Extrusion speed
- Deposition speed
- Deposition strategies
- Design and optimization of supporting structures
- Influence of process parameters on part quality
- Analysis of process tolerances
- Dimensional inspection of built parts



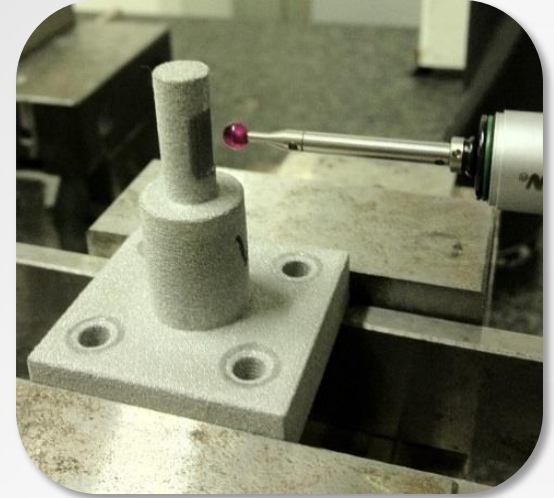
# Requirements

Good attitude for experimental tests.

Good attitude for numerical computing and mathematics is fundamental.

During the project the student will get trained to use a Coordinate Measuring Machine (CMM) for inspection and measurements of built parts.

Committment for a minimum project period of 3 months (B.Sc.) or 6 months (M.Sc.).



## Important notice

The early handing in of the thesis draft is a strict requirement. In order to graduate in the desired session the student should hand in the draft to the supervisor at least two weeks before the deadline of the students' office.