

Fundamentals of Metal Based Additive Manufacturing (3D Printing)

NONTRADITIONAL MANUFACTURING PROCESSES

Lab ME 7338/5338

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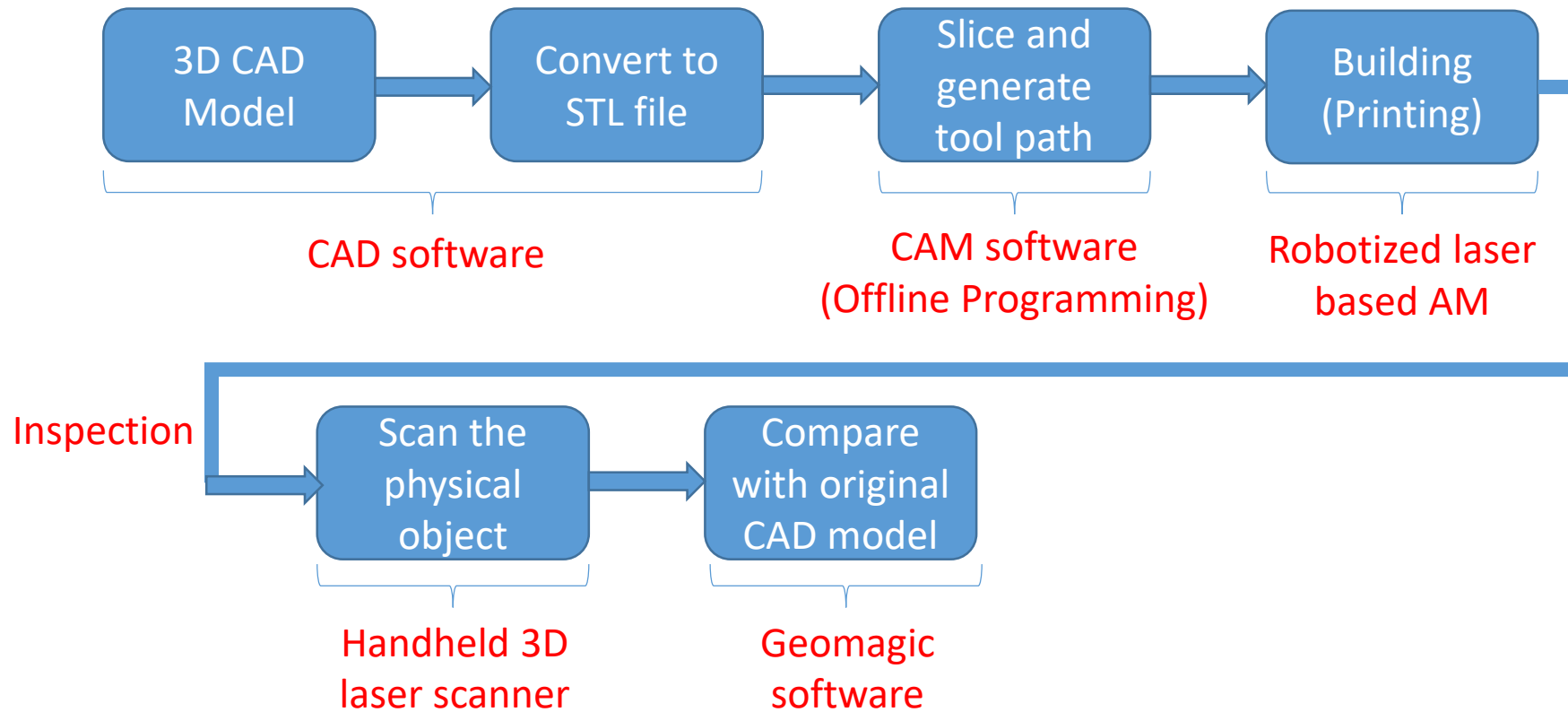
Fall 2018



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Additive Manufacturing Process

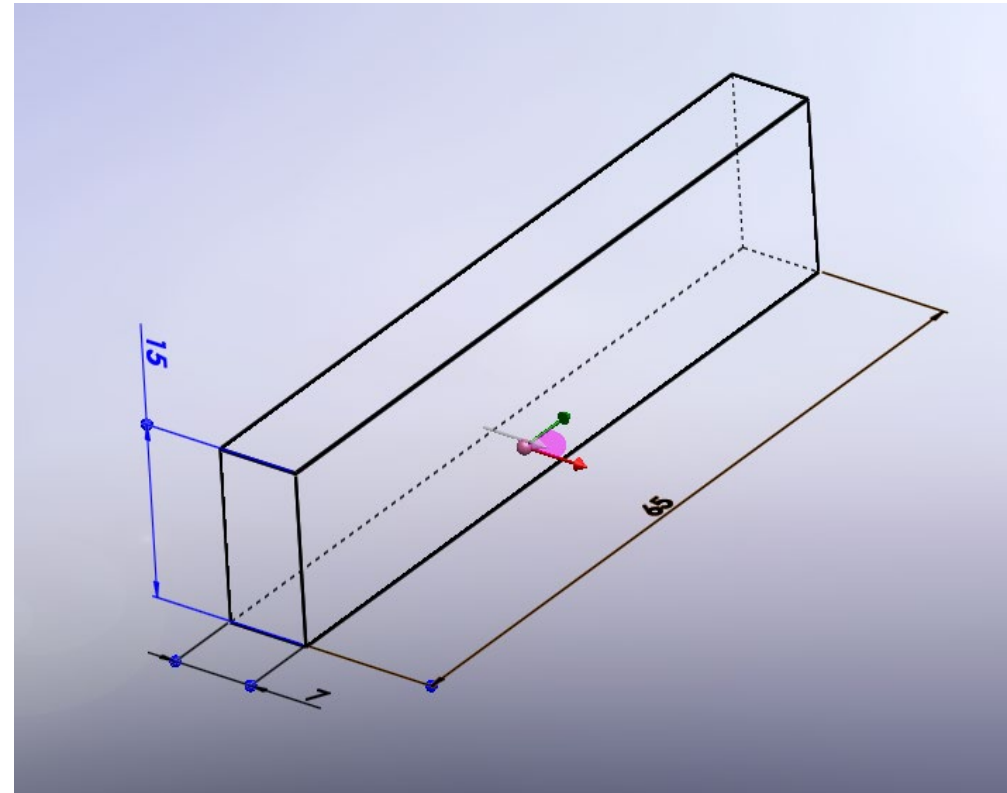


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1- 3D Modeling (A case of building a block)

- Using one of the commercial CAD software (e.g. SolidWorks) to design and model a simple block



3D CAD model



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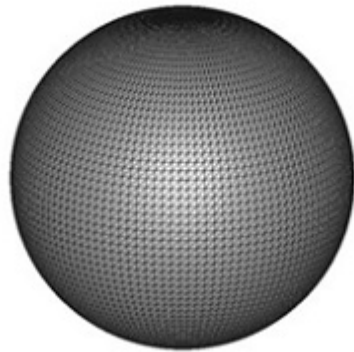
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2- Converting solid model to STL file format

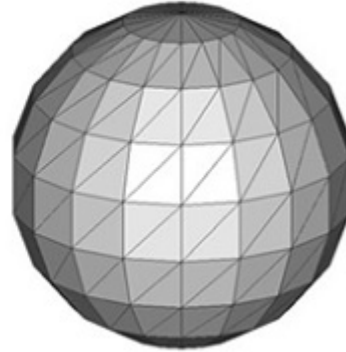
- **STL (Standard Tessellation Language)** is the standard file format for the rapid prototyping industry
- STL is ideal as it approximates the surface of a parametric solid model with a mesh of triangles
- The finer the STL triangles, the larger the file is in size



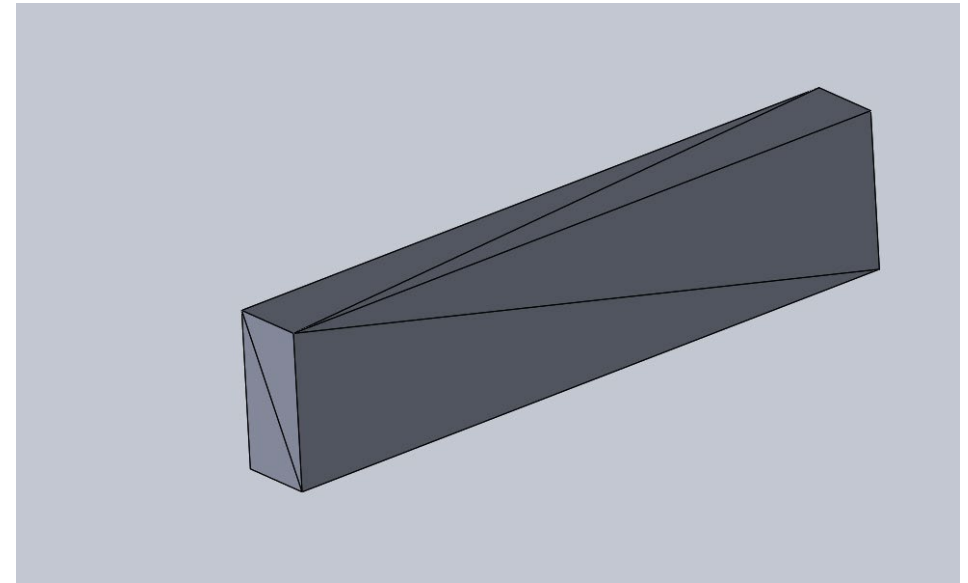
Solid Model



STL with fine
mesh



STL with
coarse mesh



STL model

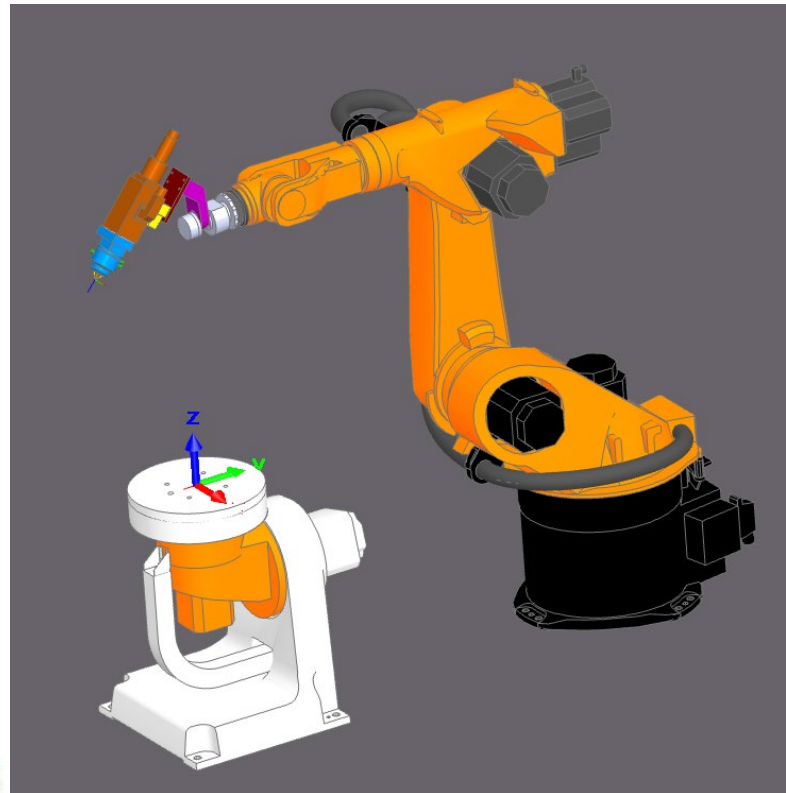


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3- Slicing and generating the tool path

- There is an offline robot programming software called “SKM DCAM” in RCAM which is used for slicing, defining tool path and generating codes for a 6+2 axis KUKA robot.

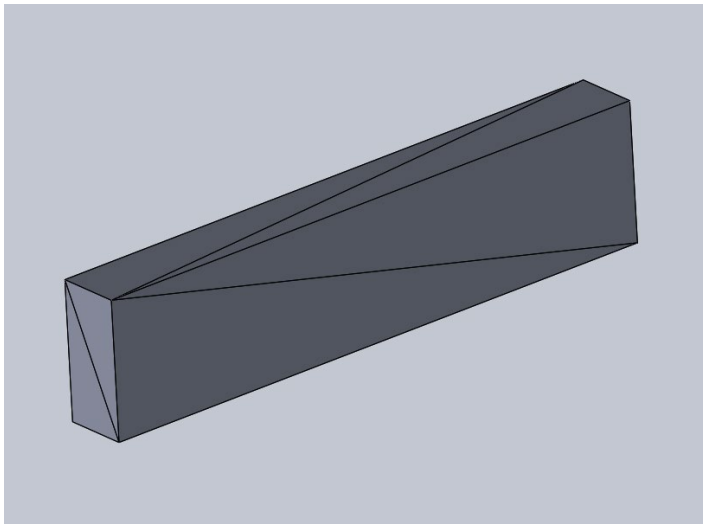


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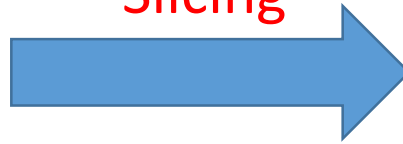
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3- Slicing the STL model

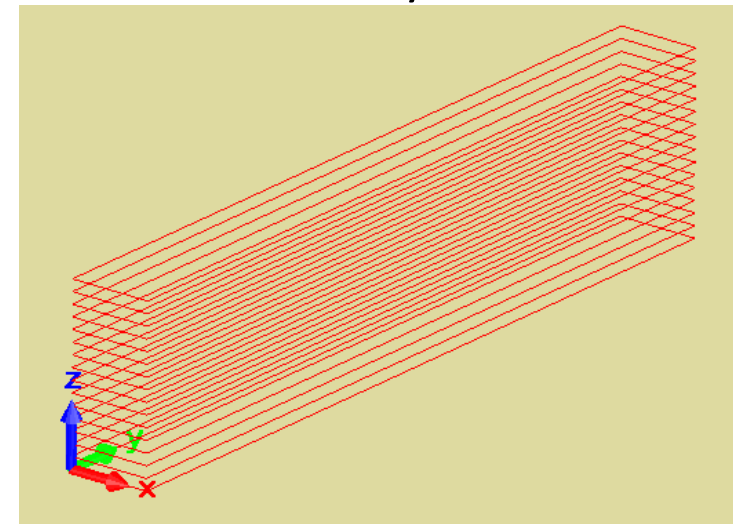
STL Model



Slicing



Sliced Layers

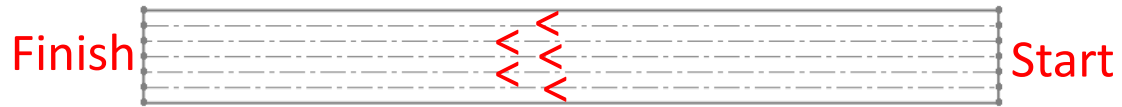


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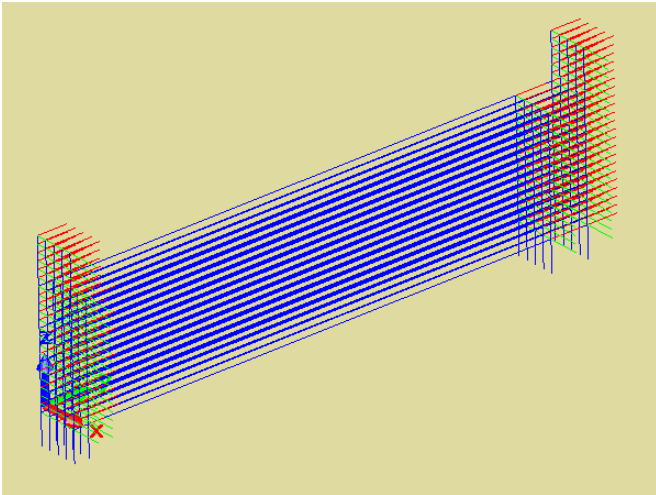
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4- Generating the tool path

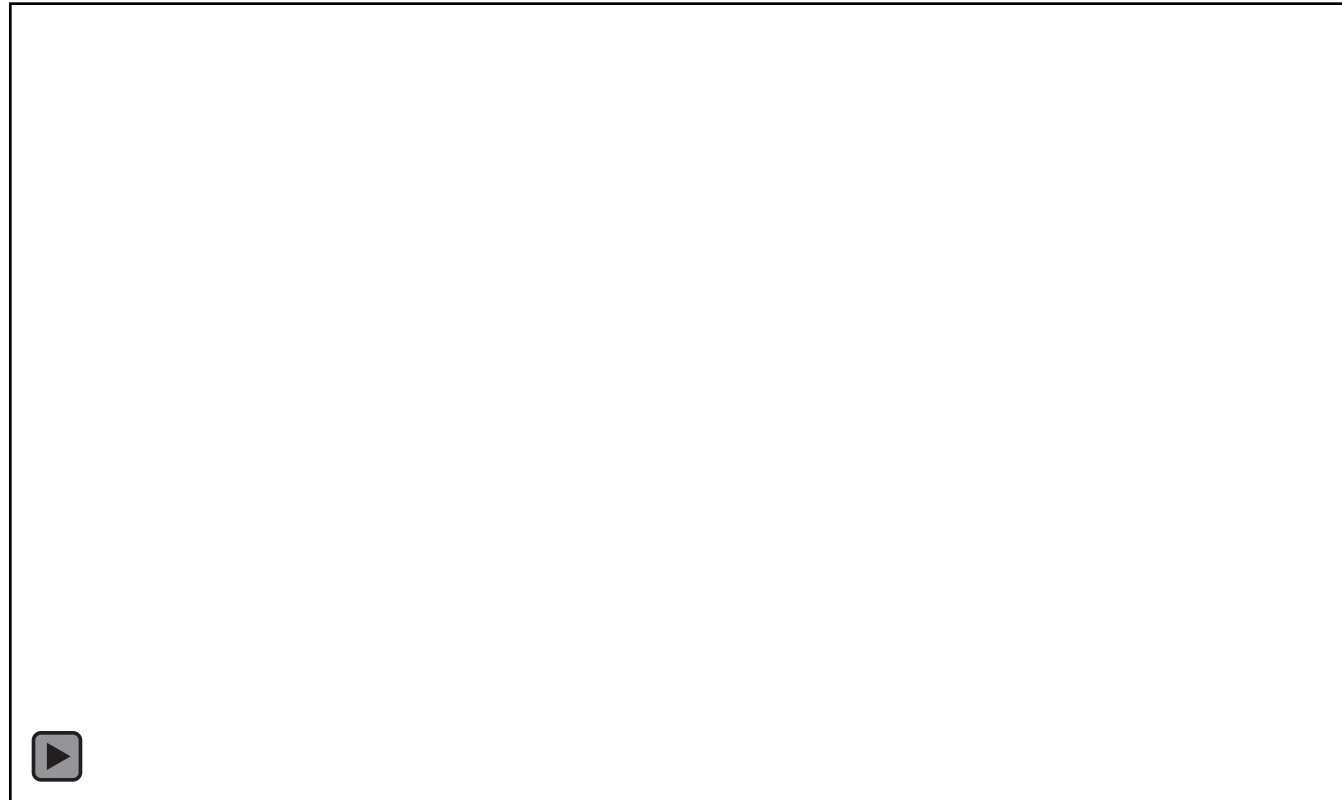
Tool path strategy in each layer



Tool path strategy in the entire part



Virtual
Simulation



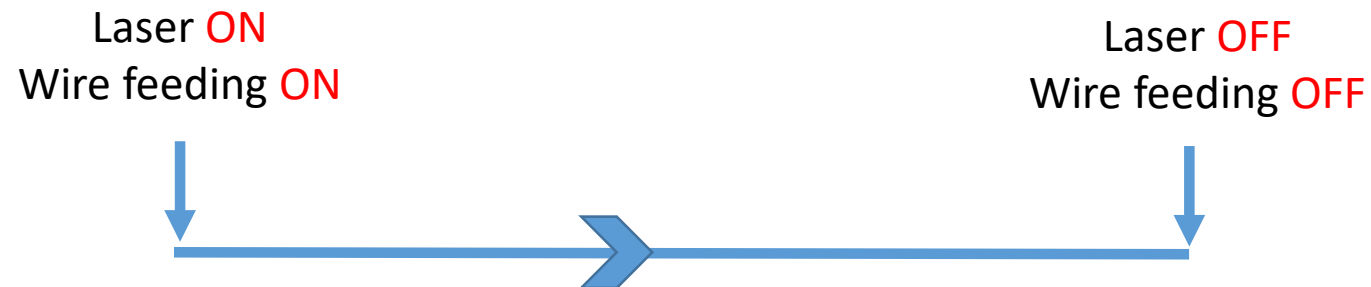
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5- Generating code for actual robot motion

Part of the generated code by DCAM software:

WIREFEEDERON() → signal for turning on the wire
LASERON() → signal for switching on the laser
\$VEL.CP=0.020 → defining the speed of robot for deposition
LIN {X -0.8, Y -64.33, Z 0.0} C_DIS → command for moving the robot to the desired position
WIREFEEDEROFF() → signal for turning off the wire
LASEROFF() → signal for turning off the wire

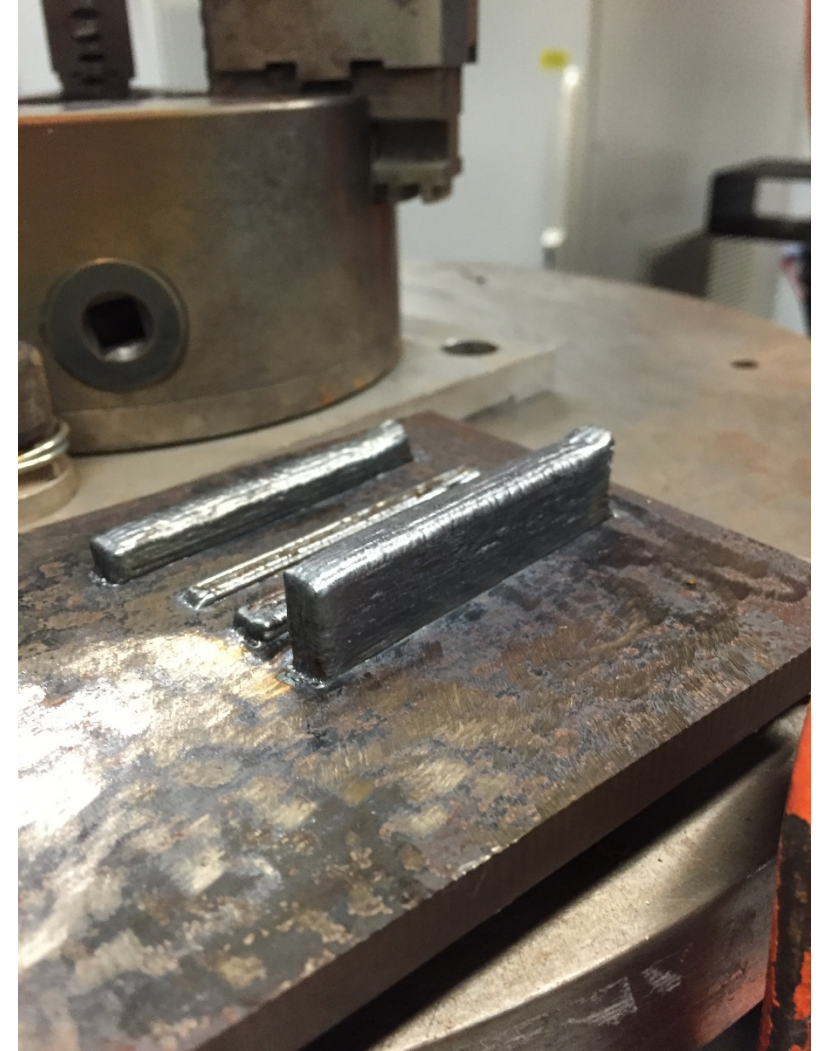


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6- Building the component

Final Object

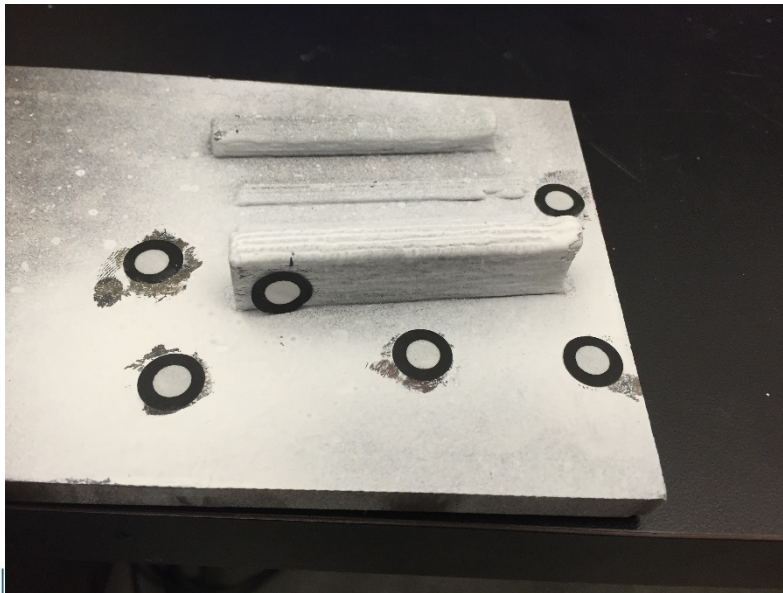


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7- Inspection and verification

- White developer is used to make a suitable contrast between object and target points.
- For easy detection by 3D laser scanner, some target points are placed on the object and its immediate surroundings.
- To inspect the object, a handheld 3D laser scanner is used to scan all surfaces of the object.



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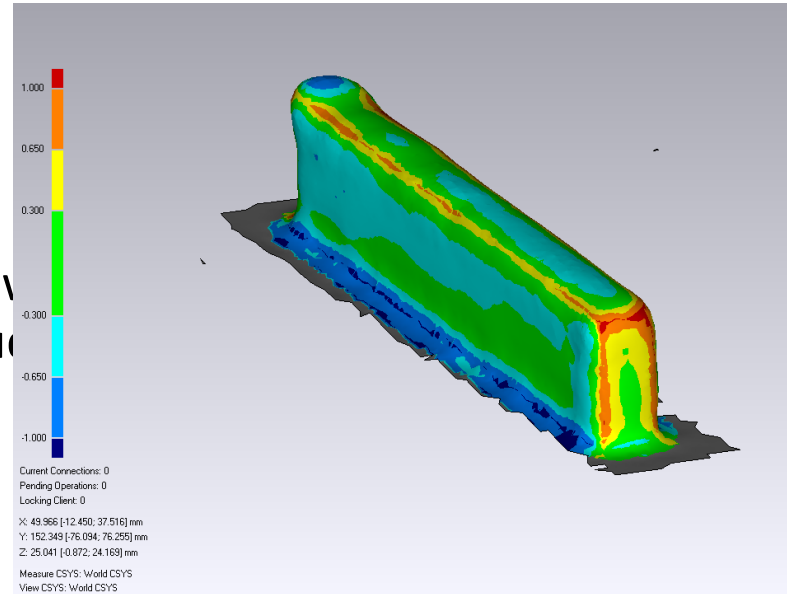
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7- Inspection

After obtaining 3D CAD data of the object, a well-known application (Geomagic Studio) is used to process these data including:

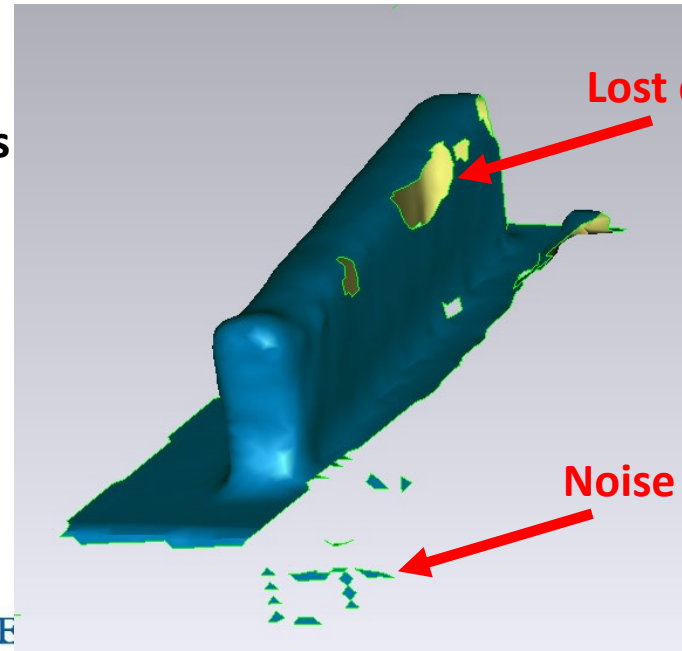
- Repair and fill all lost areas
- Clean and reduce noise
- Smooth the surface
- Align the object with a new origin
- Convert the mesh triangles to solid surfaces
- Compare with original model to calculate the deviations

3D Analyzing (Deviations)

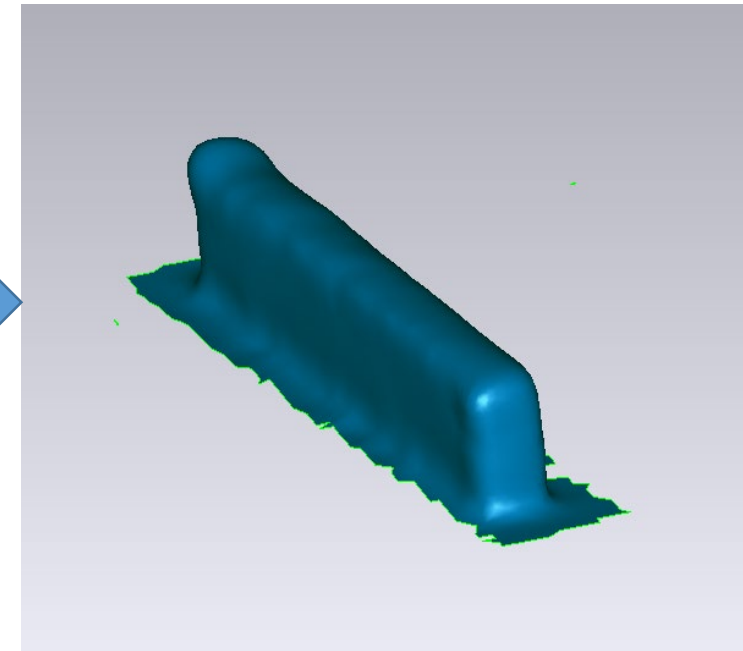


application

Original STL file from Scanner



After data processing in Geomagic



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A photograph of the entrance to Southern Methodist University. A low brick wall with the university's name in stone letters spans the middle ground. Behind it, a path leads into a dense grove of large, leafy trees. In the foreground, there is a circular paved area with a small fountain, surrounded by a field of purple flowers.

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Thank you