Entwickeln, Validieren, Herstellen

Walter van Doorne

Senior Technical Sales Specialist

AUTODESK. UNIVERSITY

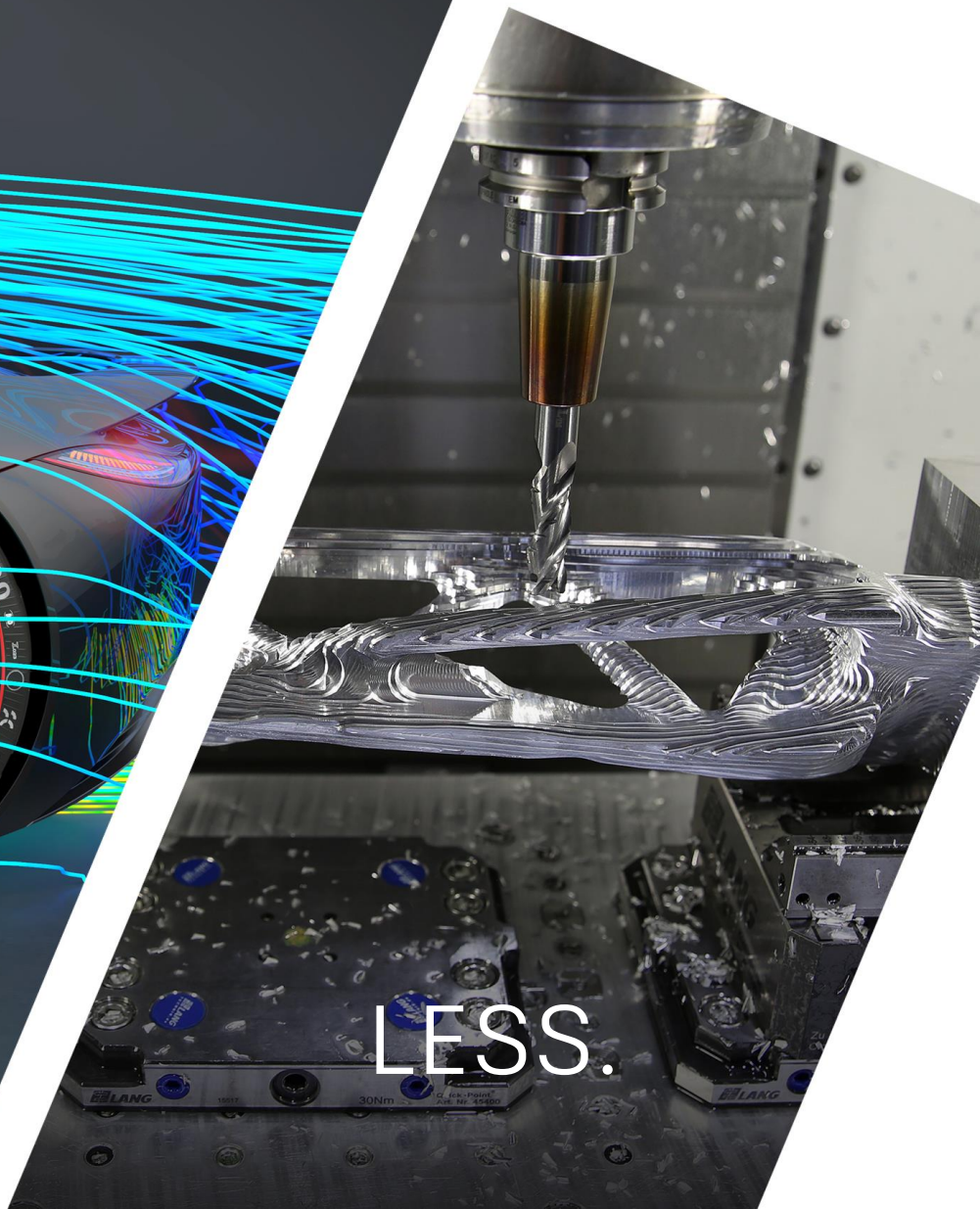
MORE.

MORE.

BETTER.

MORE.

BETTER.



LESS.

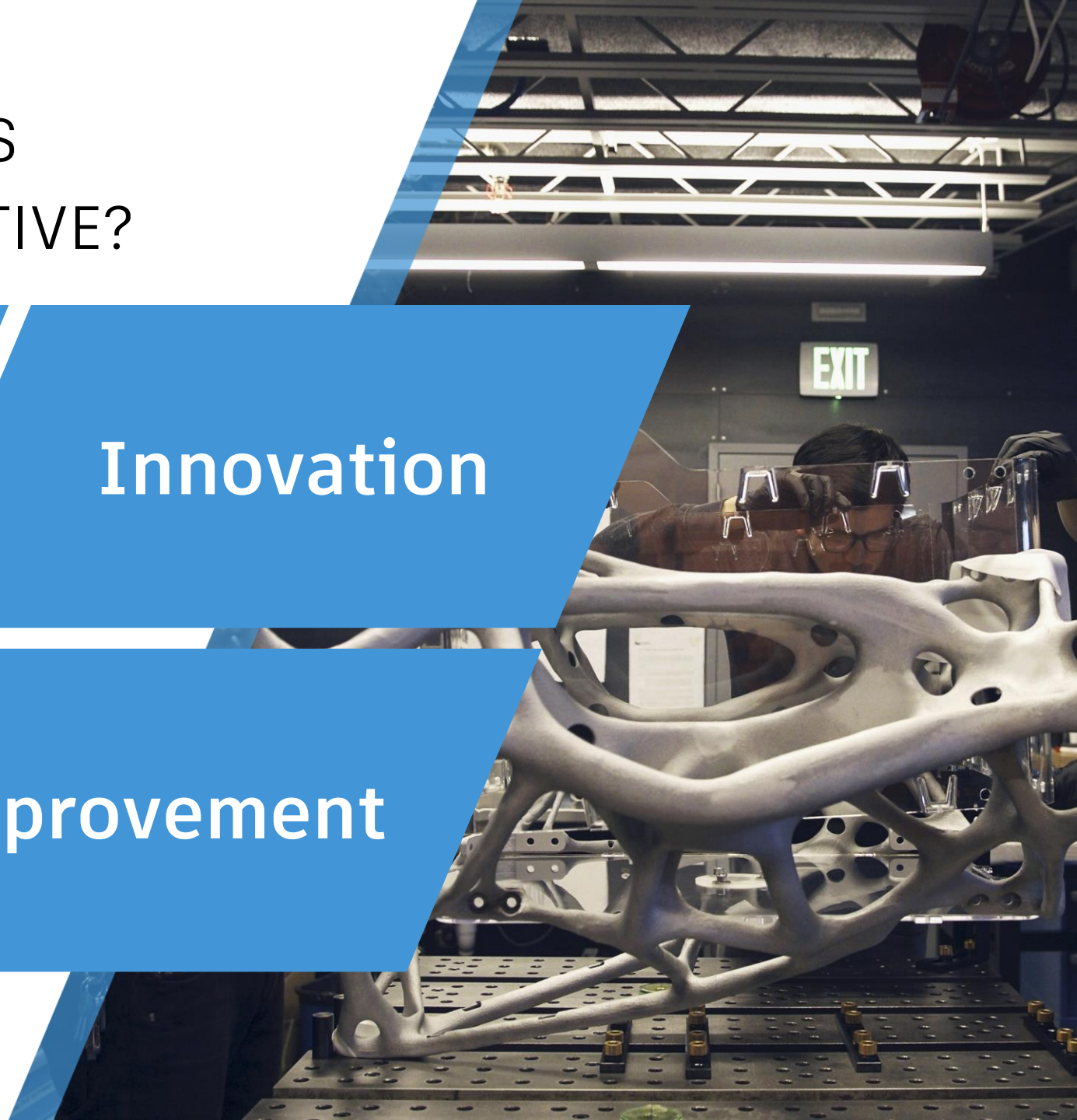
WHAT DO YOUR CUSTOMERS NEED TO REMAIN COMPETETIVE?

Top line

Innovation

Bottom line

Improvement



HOW DO YOU DO THIS?

Top line

Win more business

Innovation

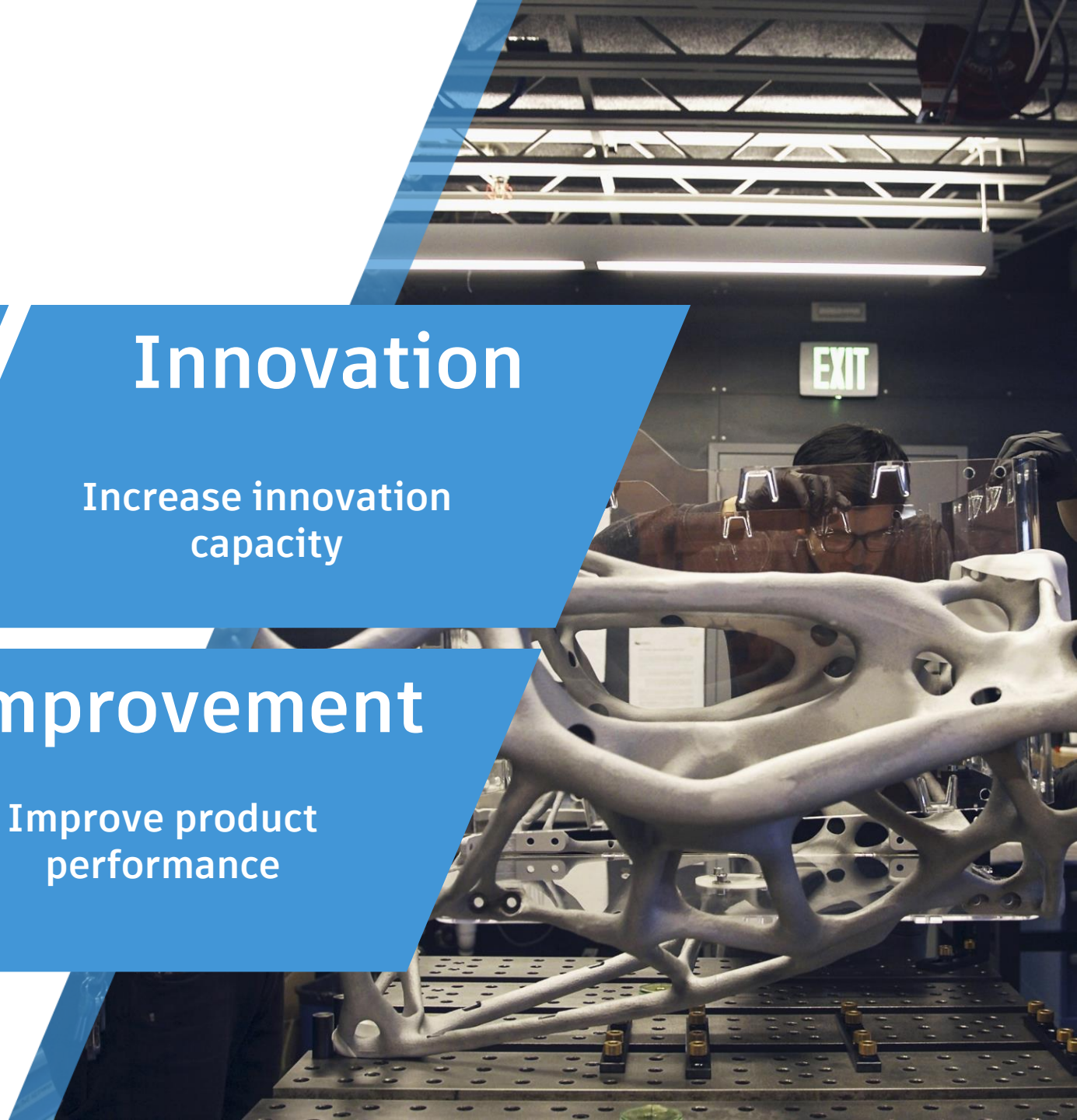
Increase innovation capacity

Bottom line

Increase operational efficiency

Improvement

Improve product performance



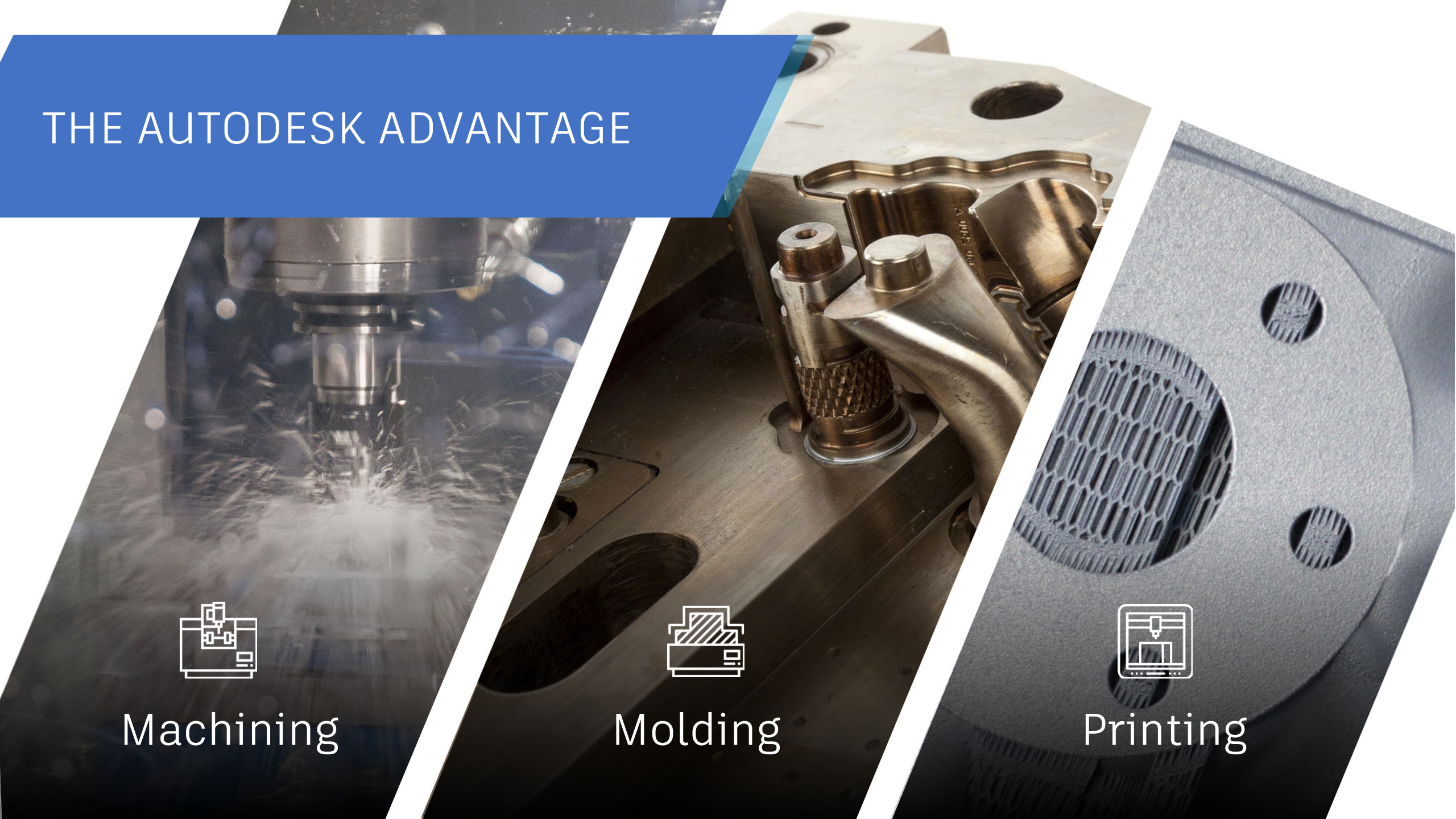
MAKE IT, WITH AUTODESK

The right product

At the right time

For the right cost

THE AUTODESK ADVANTAGE

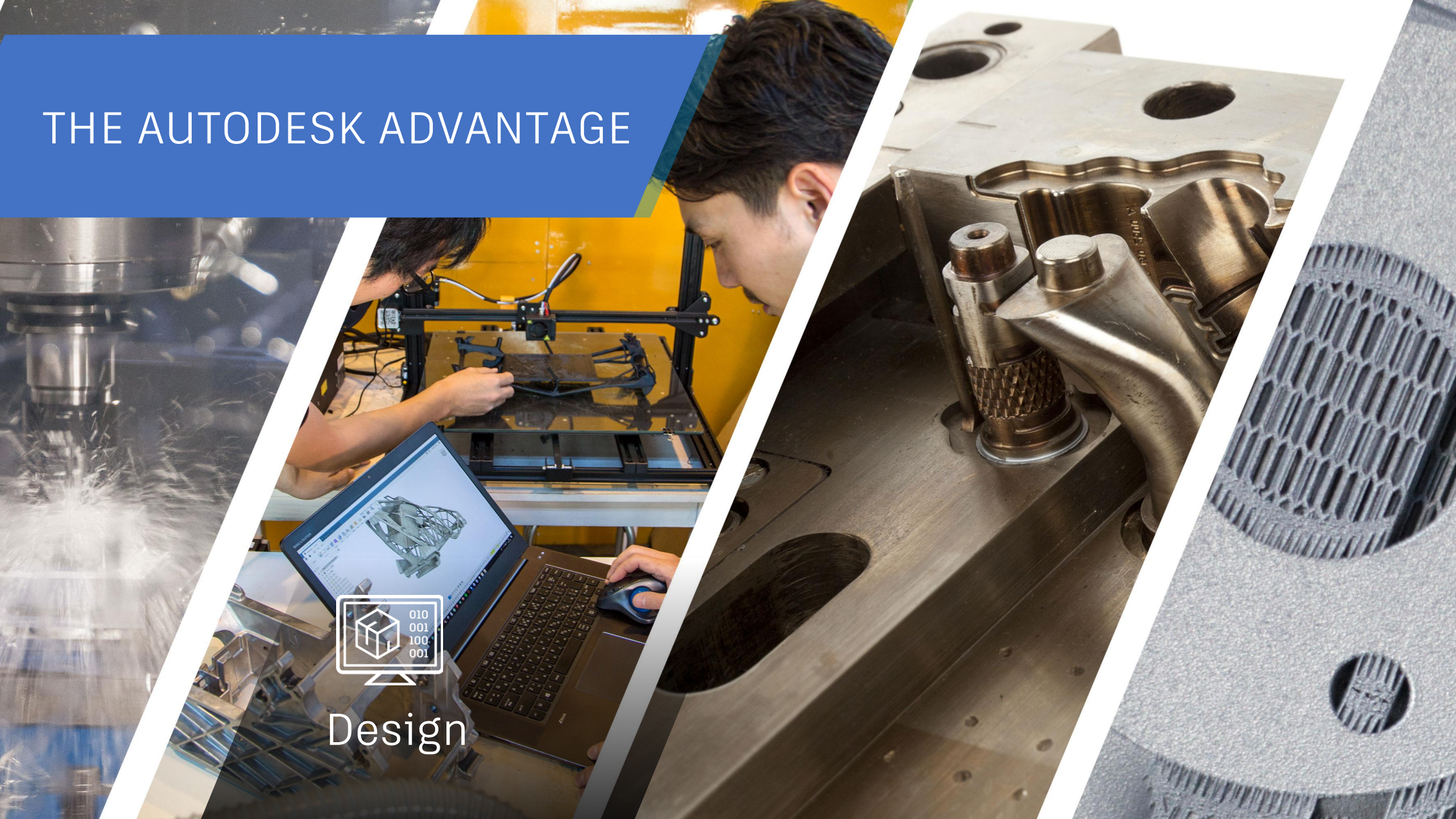


Machining

Molding

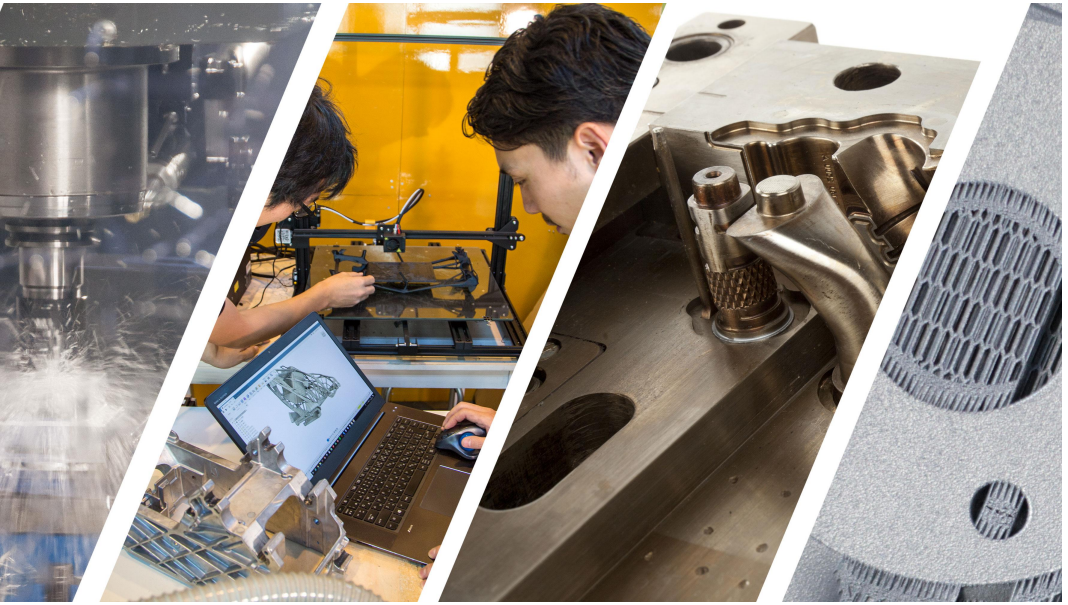
Printing

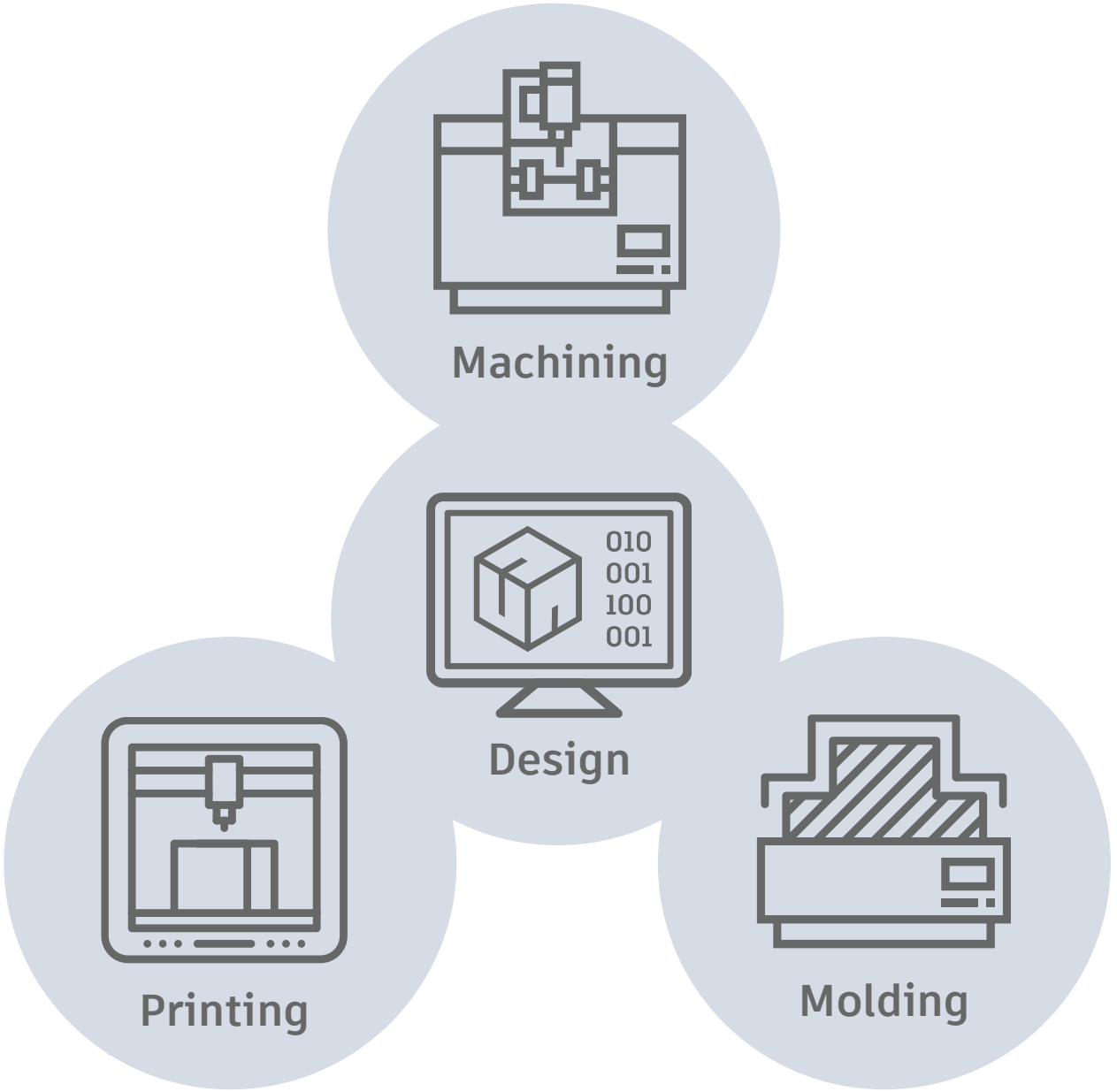
THE AUTODESK ADVANTAGE



Design

THE AUTODESK ADVANTAGE



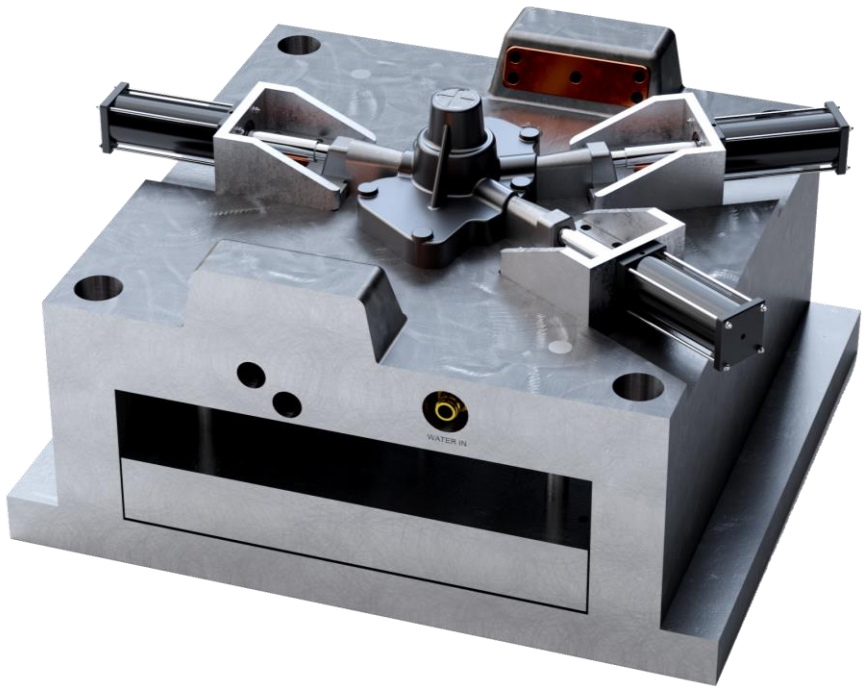


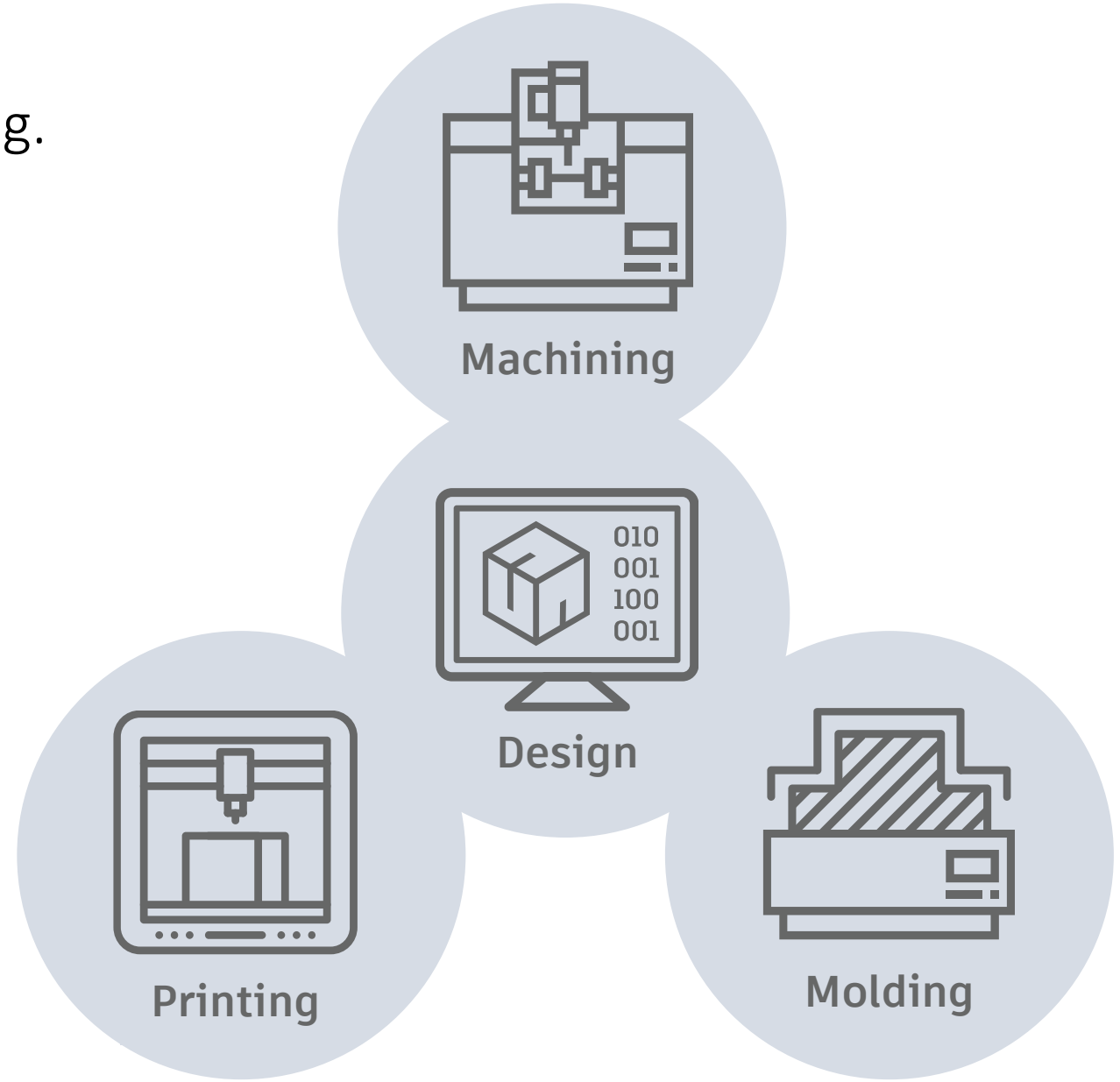
INNOVATION WORKFLOWS

How companies are already using Autodesk to make business better

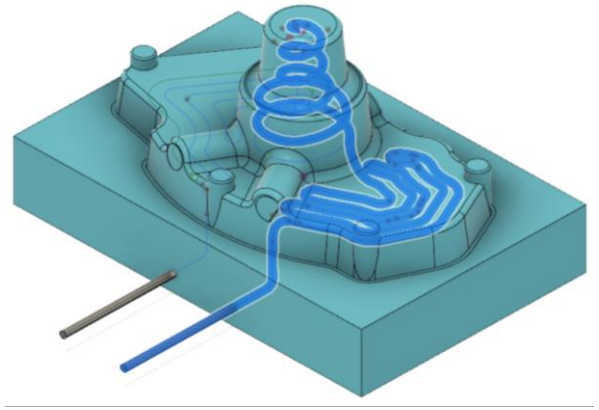
Innovation Workflow

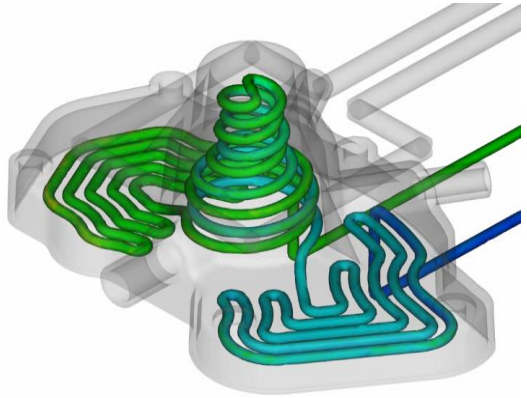
Injection Molding with Conformal Cooling.

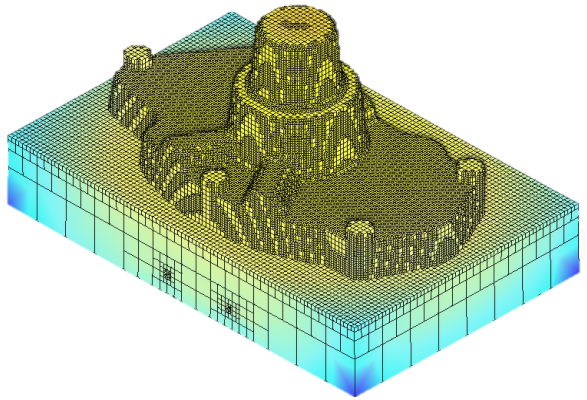


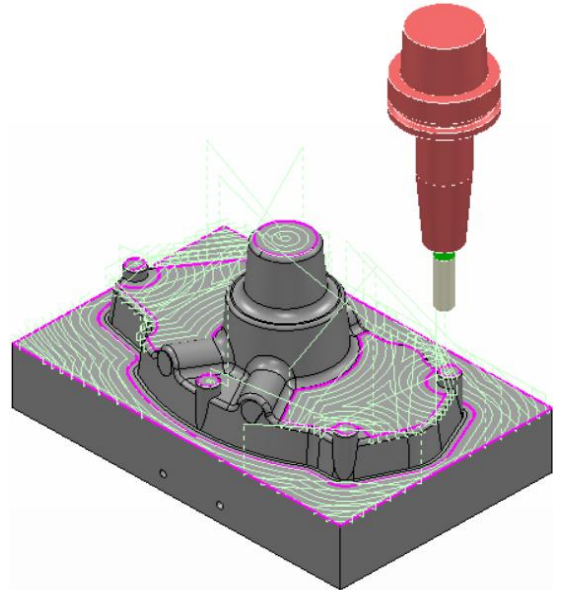


Injection Molding with Conformal Cooling







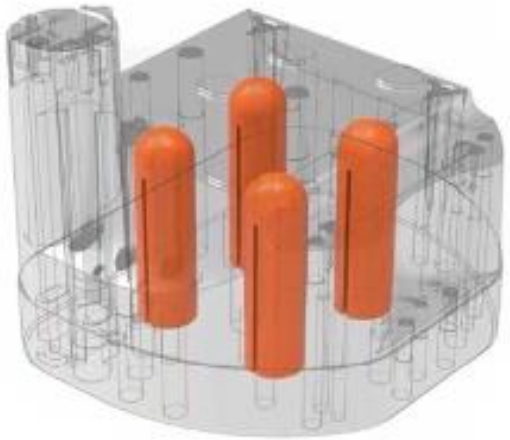


Part + Mold Design

Injection Molding Verification

Additive Manufacture

Subtractive Machining



HOW ARE MOLDS COOLED TRADITIONALLY?

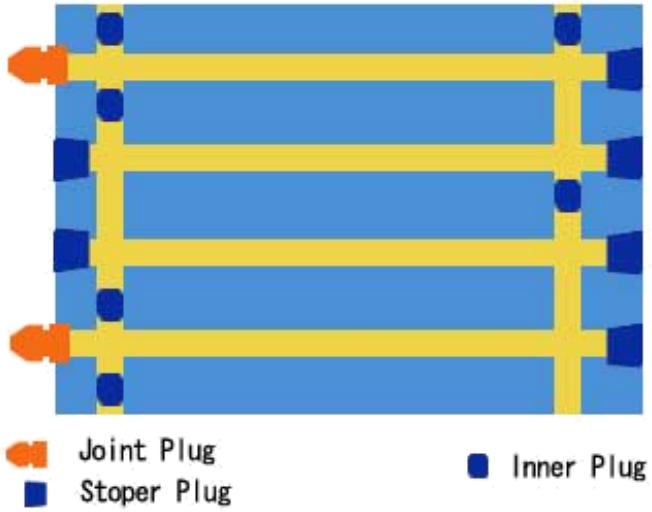
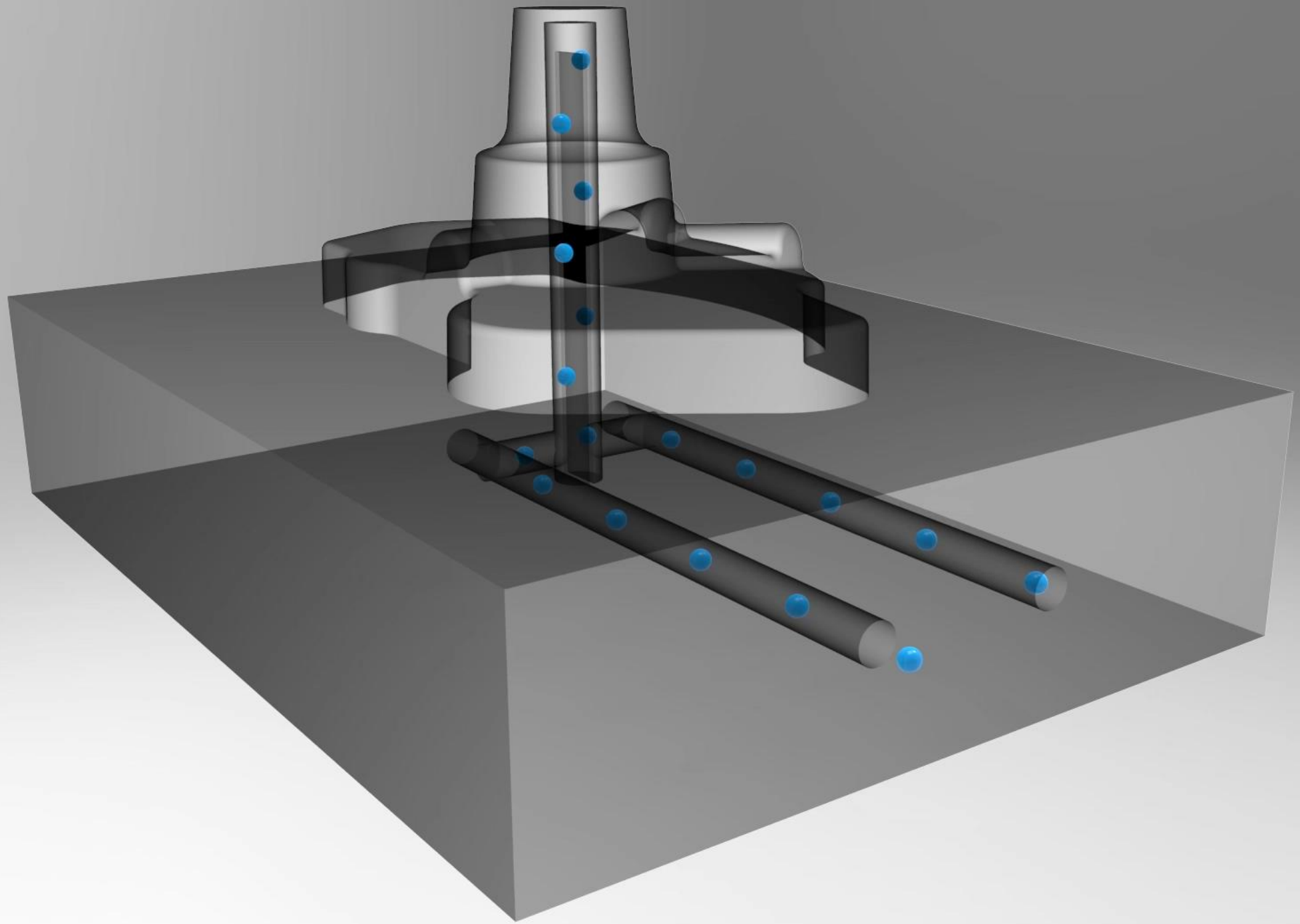
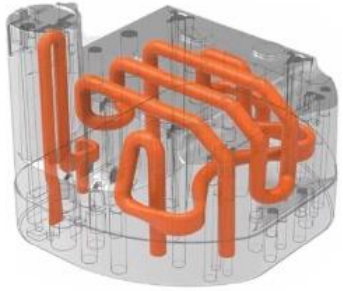
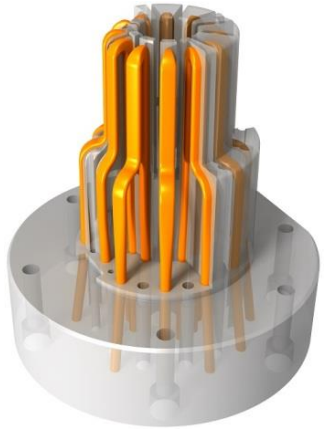
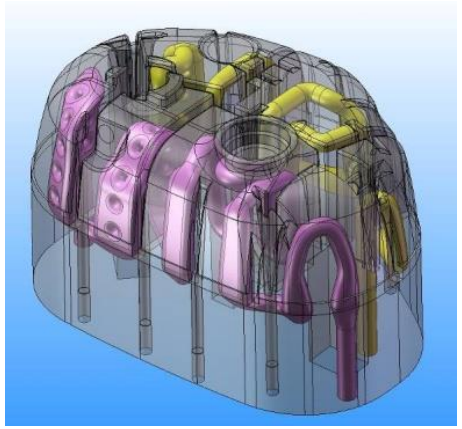


Image Credit: http://mould-technology.blogspot.com



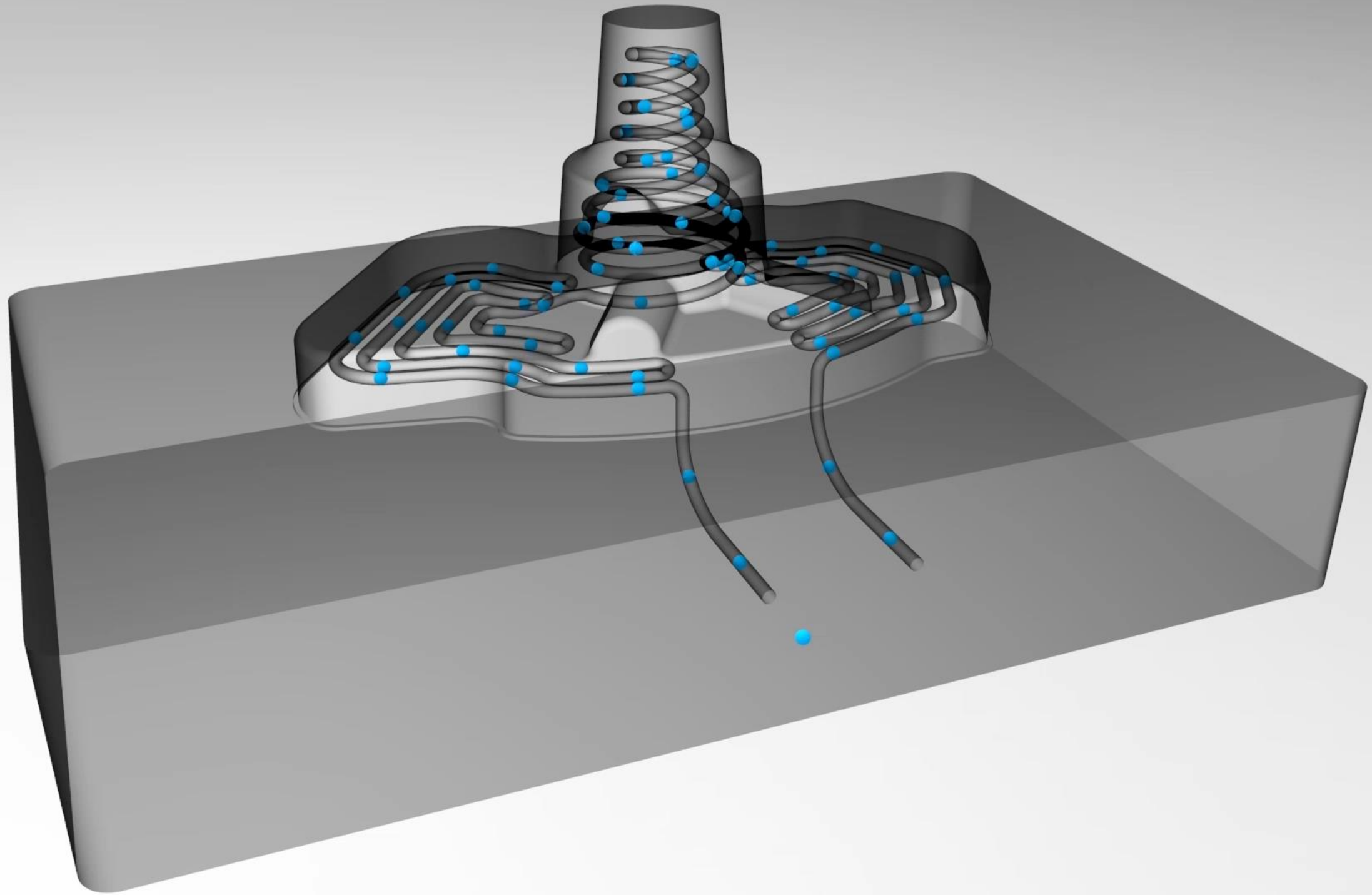




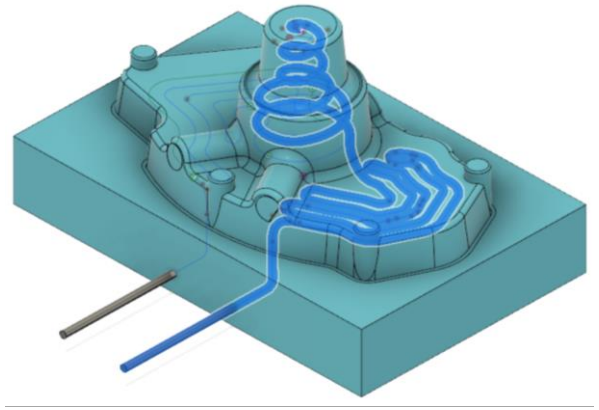


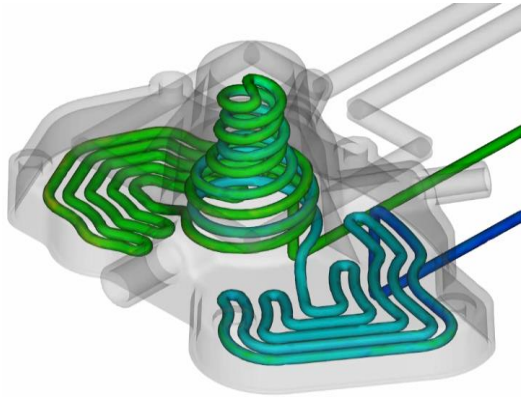
WHAT IS CONFORMAL COOLING?

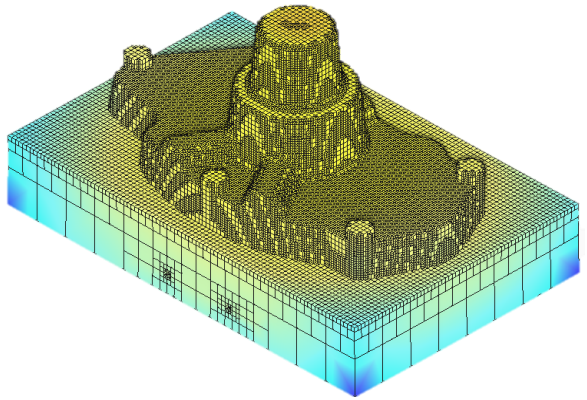
A Conformal cooling channel is
a cooling passageway that follows the shape
or profile of the mold core or cavity to
perform rapid, uniform cooling.

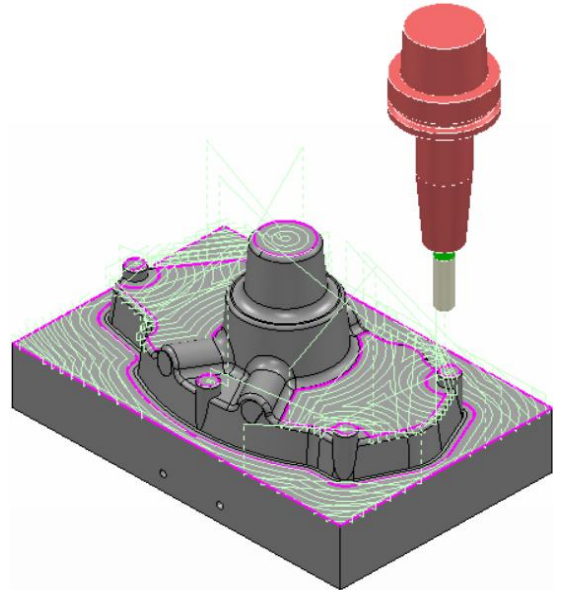


Injection Molding with Conformal Cooling









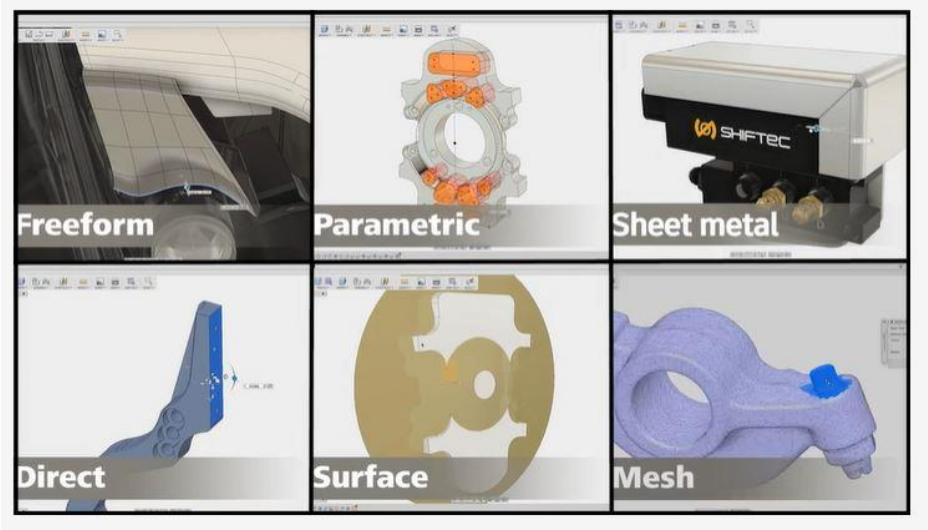
AUTODESK® FUSION 360™

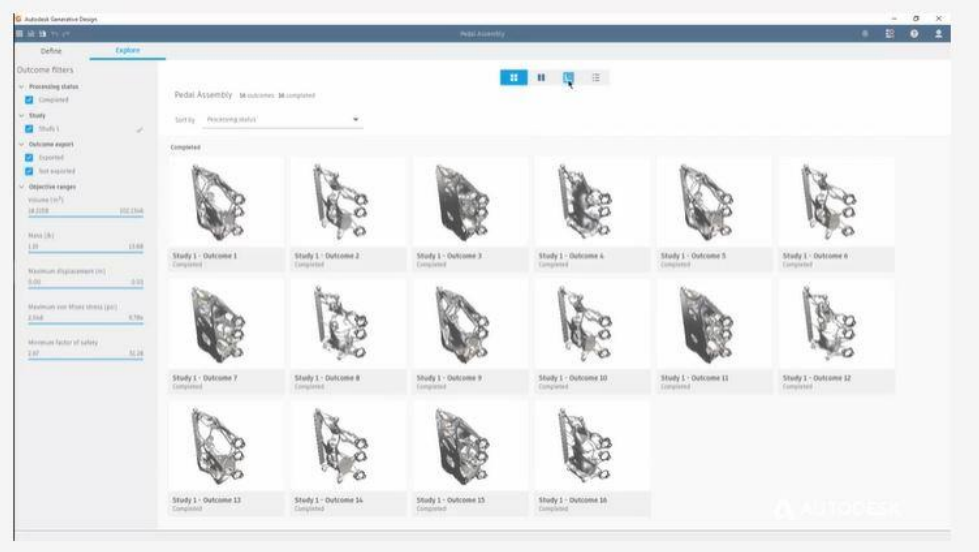
Injection Molding Verification

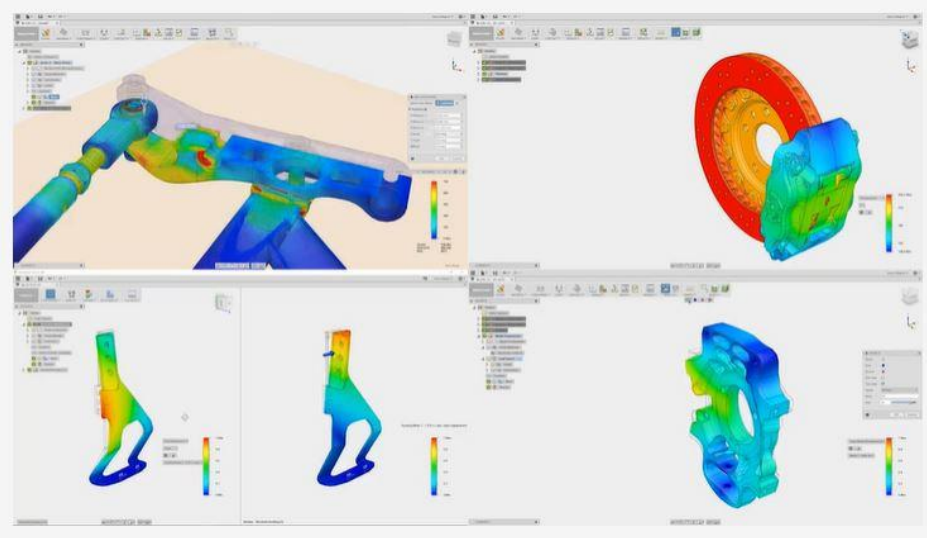
Additive Manufacture

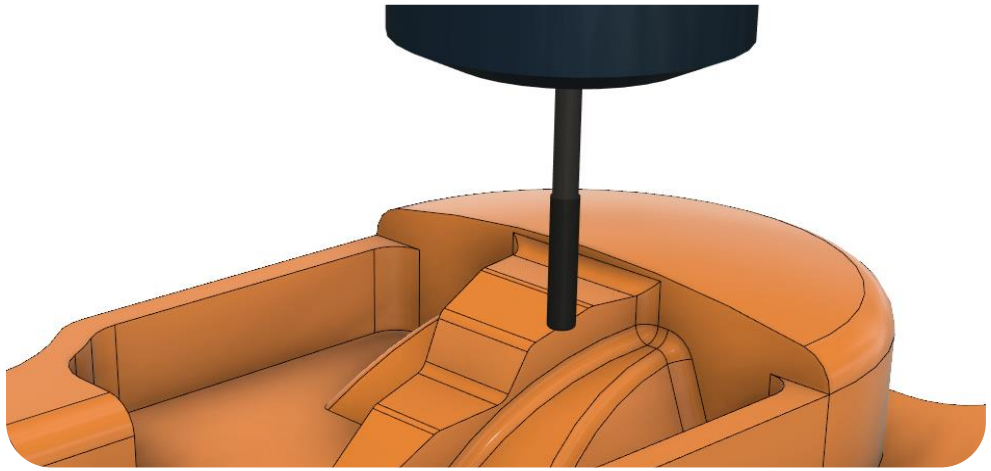
Subtractive Machining

Fusion 360 Capabilities …..

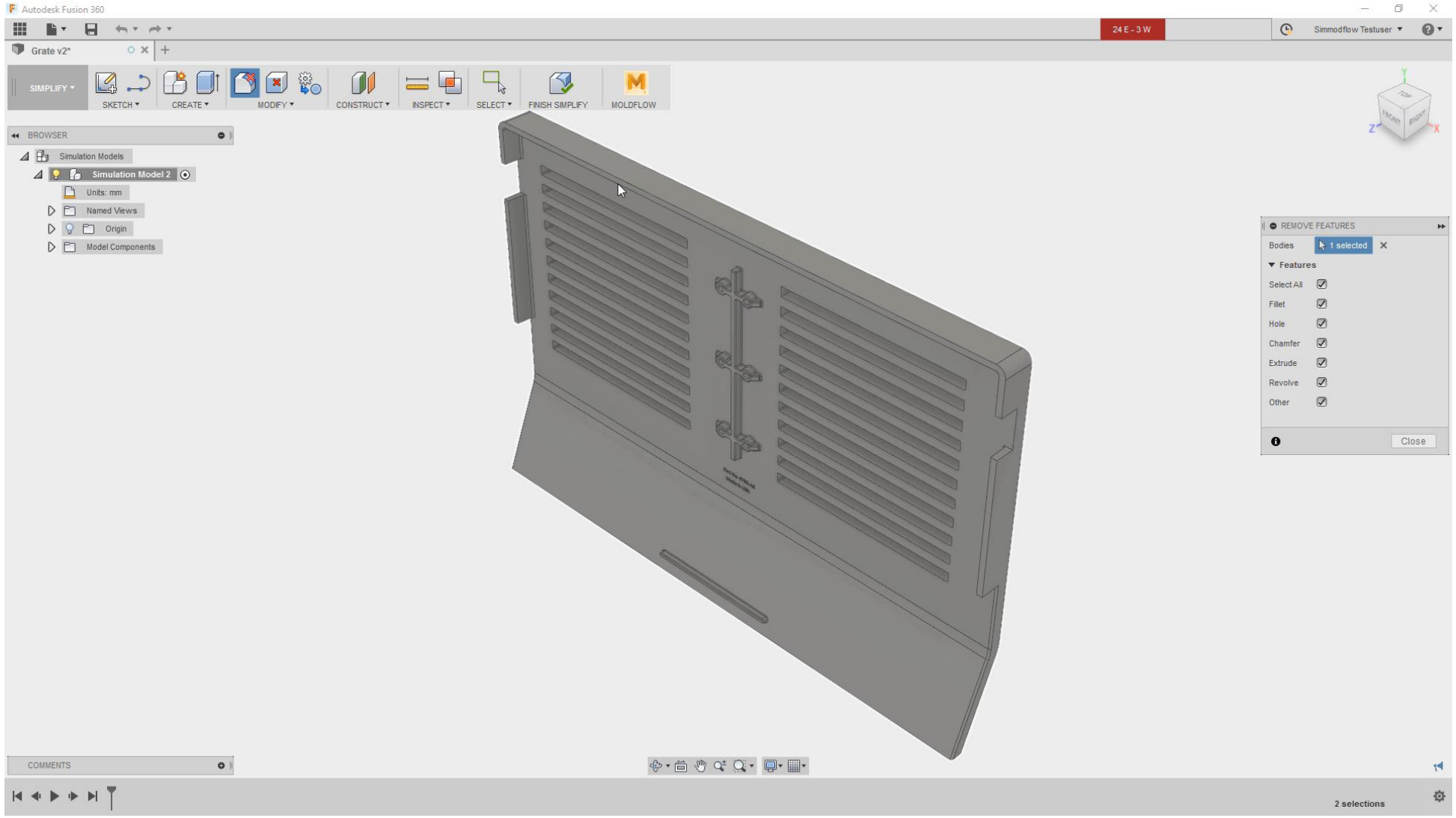








Model Simplification for Simulation



Autodesk Fusion 360

Lewis' version v11*

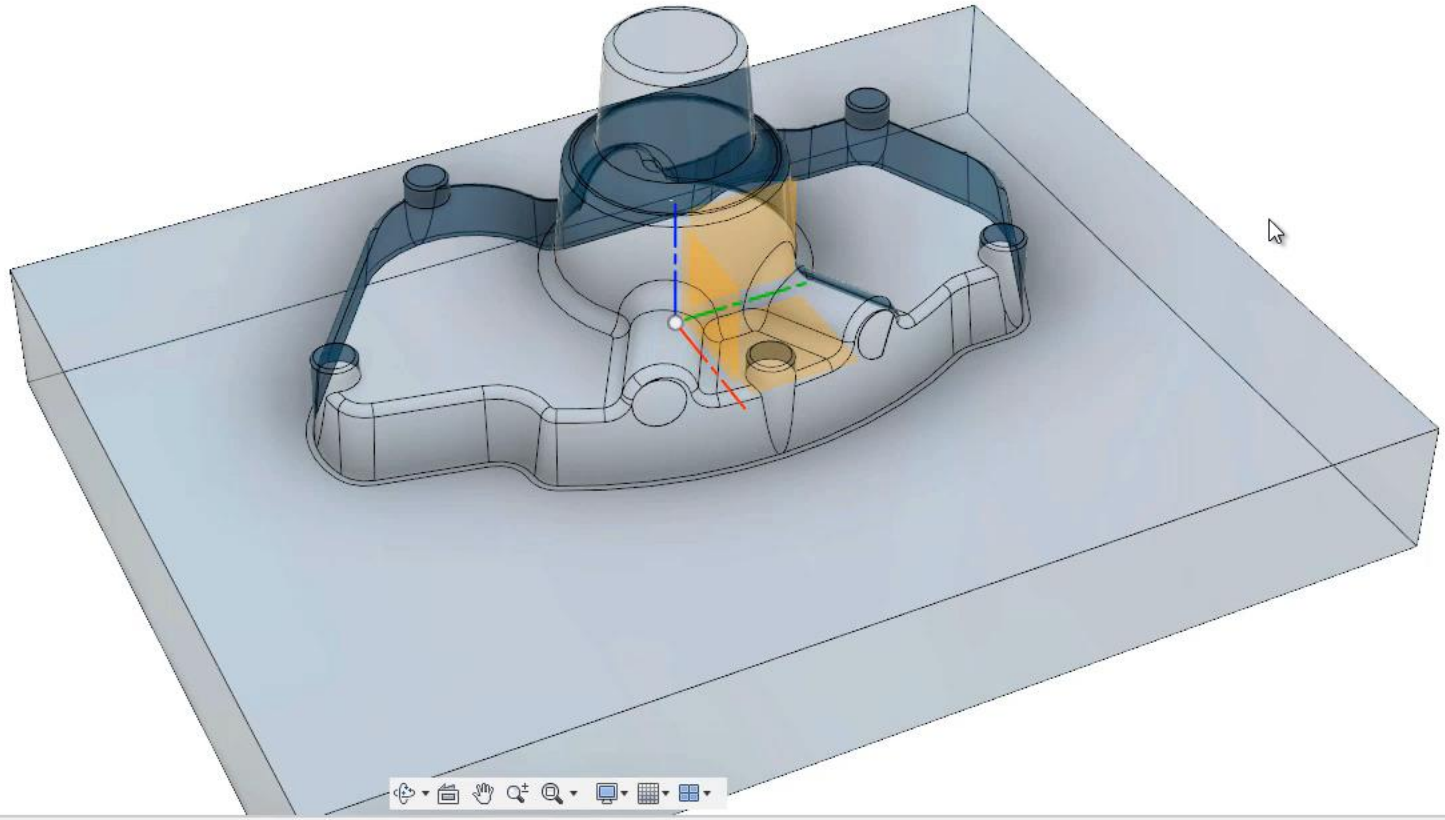
Lewis Gilday

MODEL

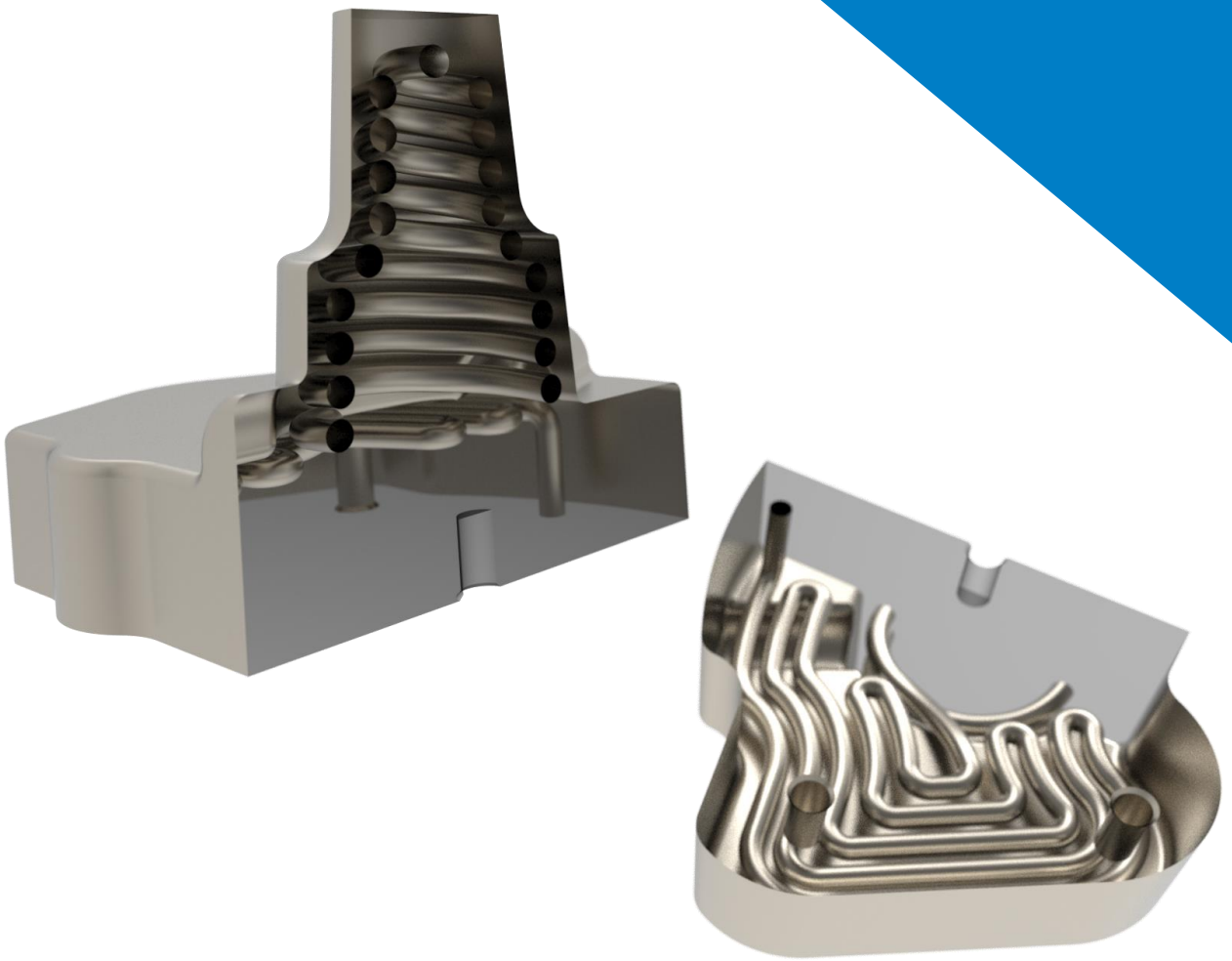
SKETCH | CREATE | MODIFY | ASSEMBLE | CONSTRUCT | INSPECT | INSERT | MAKE | ADD-INS | SELECT

BROWSER

- Lewis' version v11
  - Document Settings
  - Named Views
  - Origin
  - Bodies
    - Body3
    - Body13
  - Sketches
  - Construction
    - Plane1
    - Plane7
    - Plane8
    - Plane2
  - Component1:1
  - Component1(Mirror):1



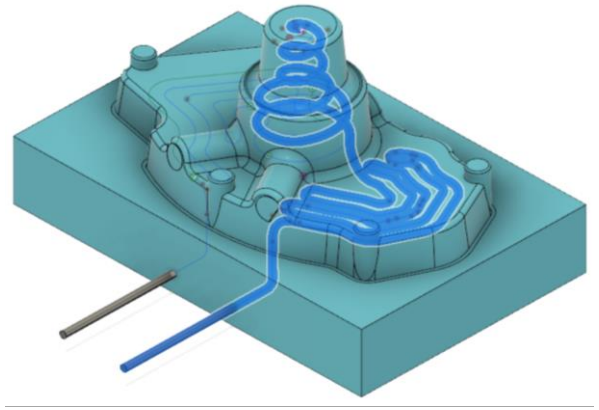
TEXT COMMANDS

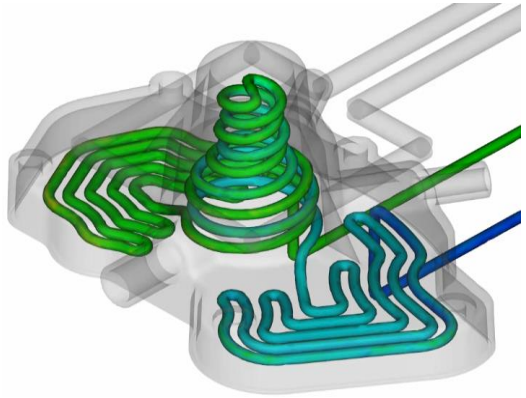


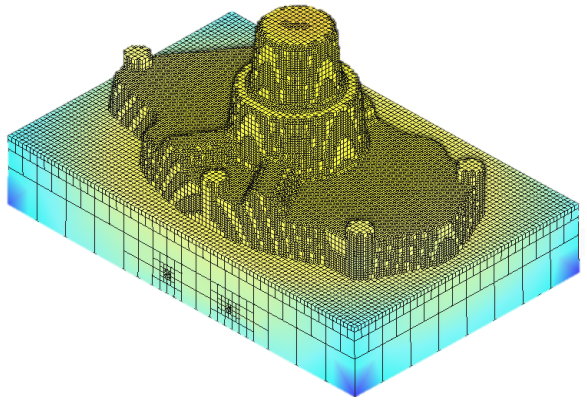
CAN THE PART NOW BE MOLDED?

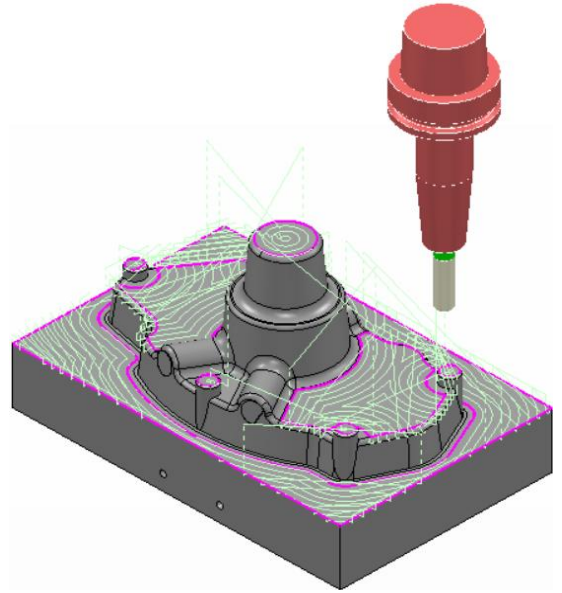

WATER IN
WATER IN

Injection Molding with Conformal Cooling







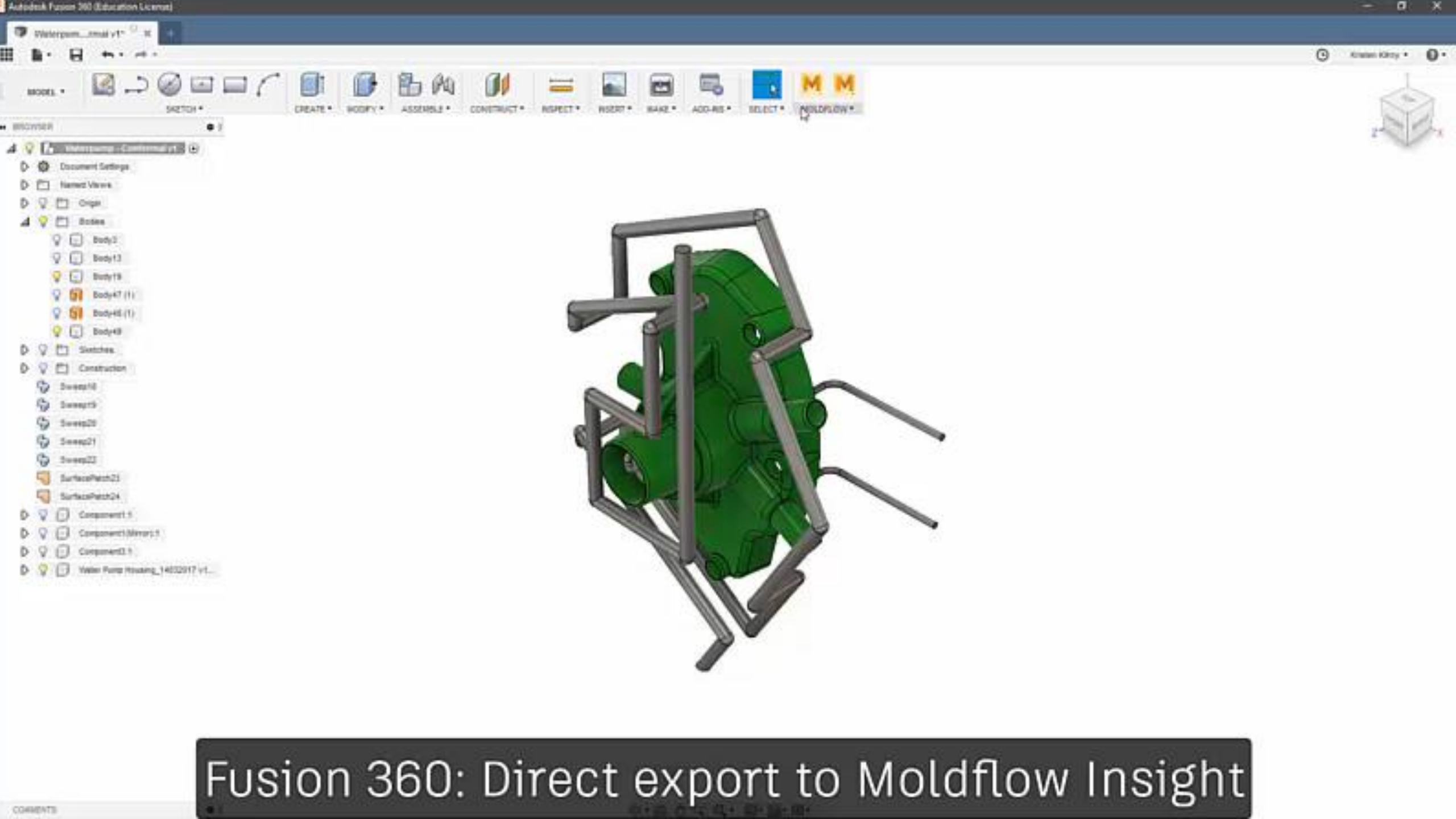


AUTODESK® FUSION 360™

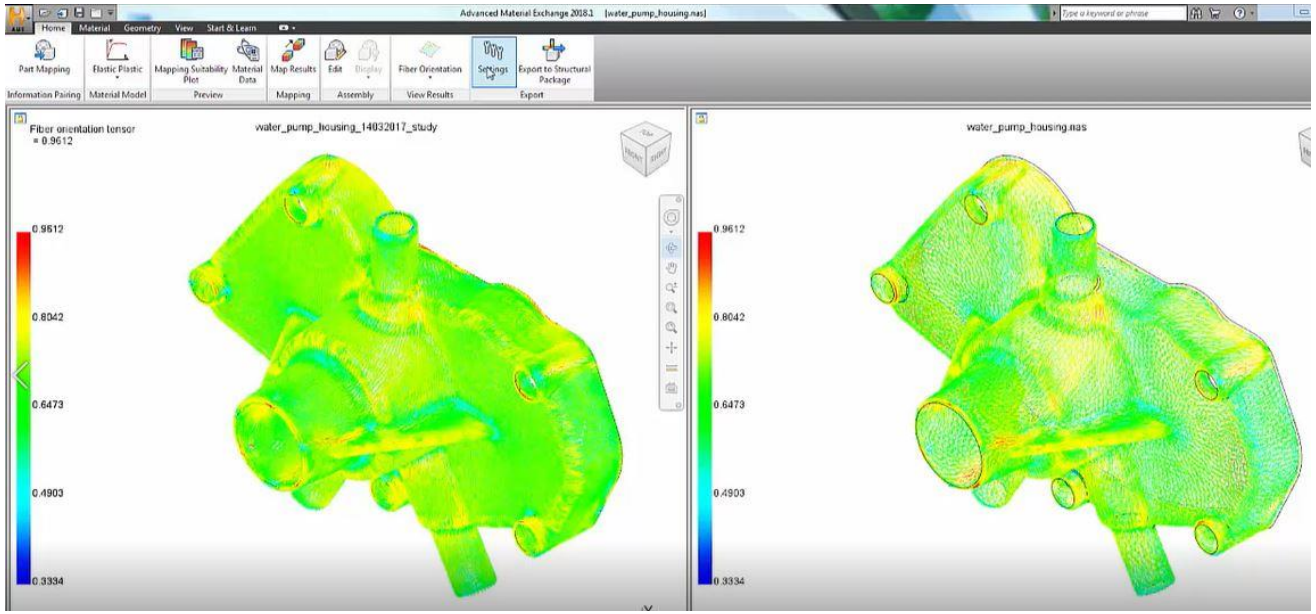
AUTODESK® MOLDFLOW®

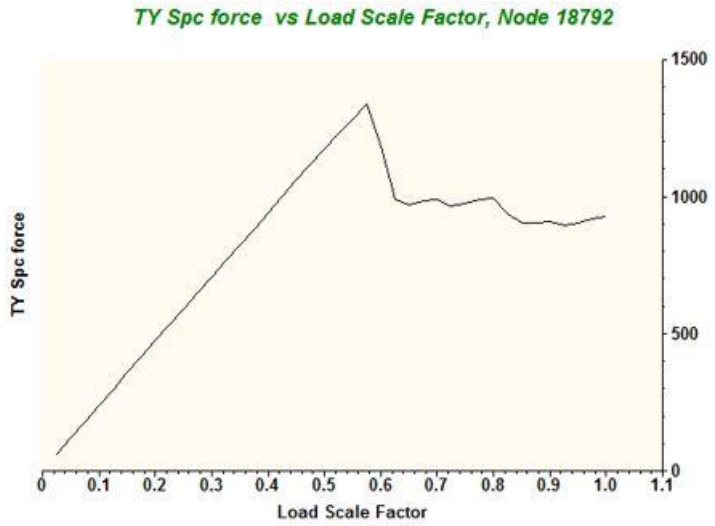
Additive Manufacture

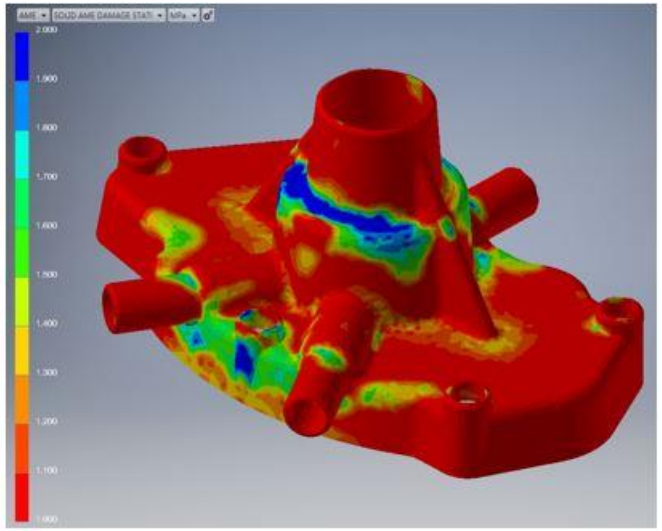
Subtractive Machining

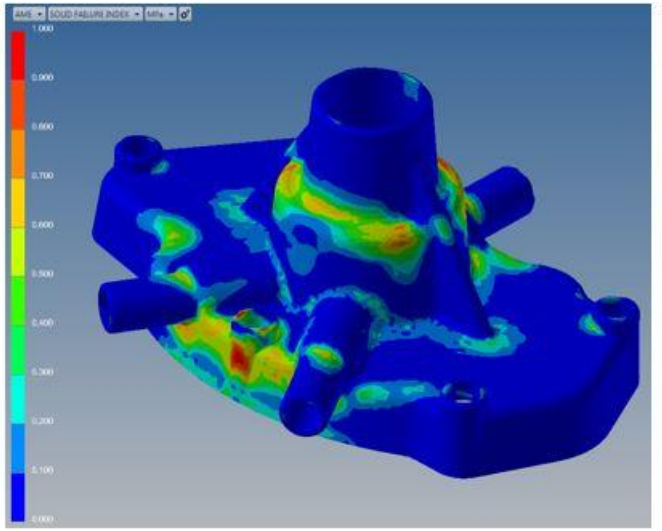

Fusion 360: Direct export to Moldflow Insight

Predict Molded Part Performance in Service





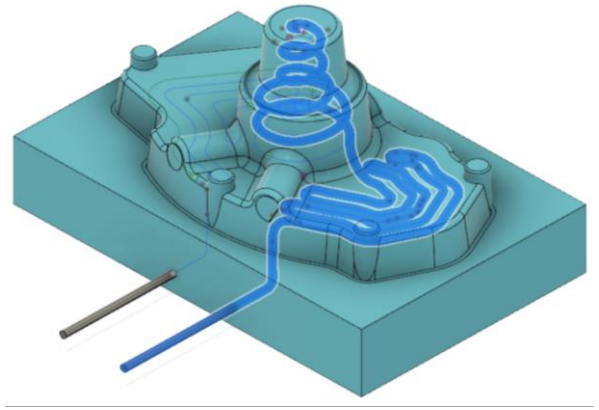


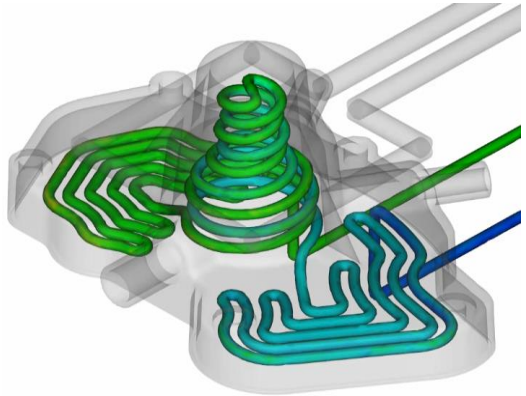


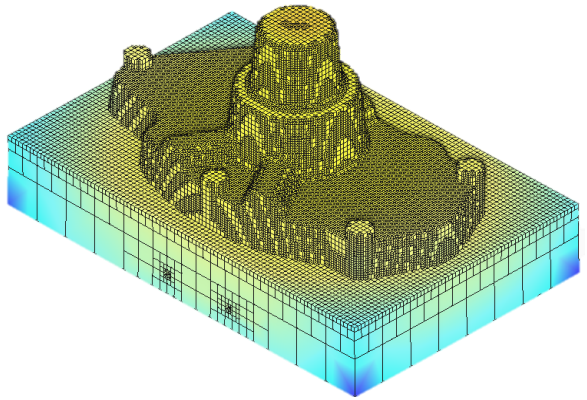
HOW ARE MOLDS MANUFACTURED?

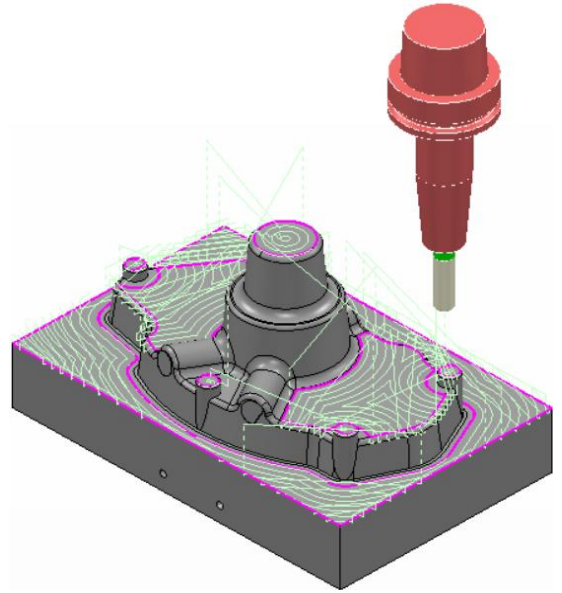

Face Milling

Injection Molding with Conformal Cooling







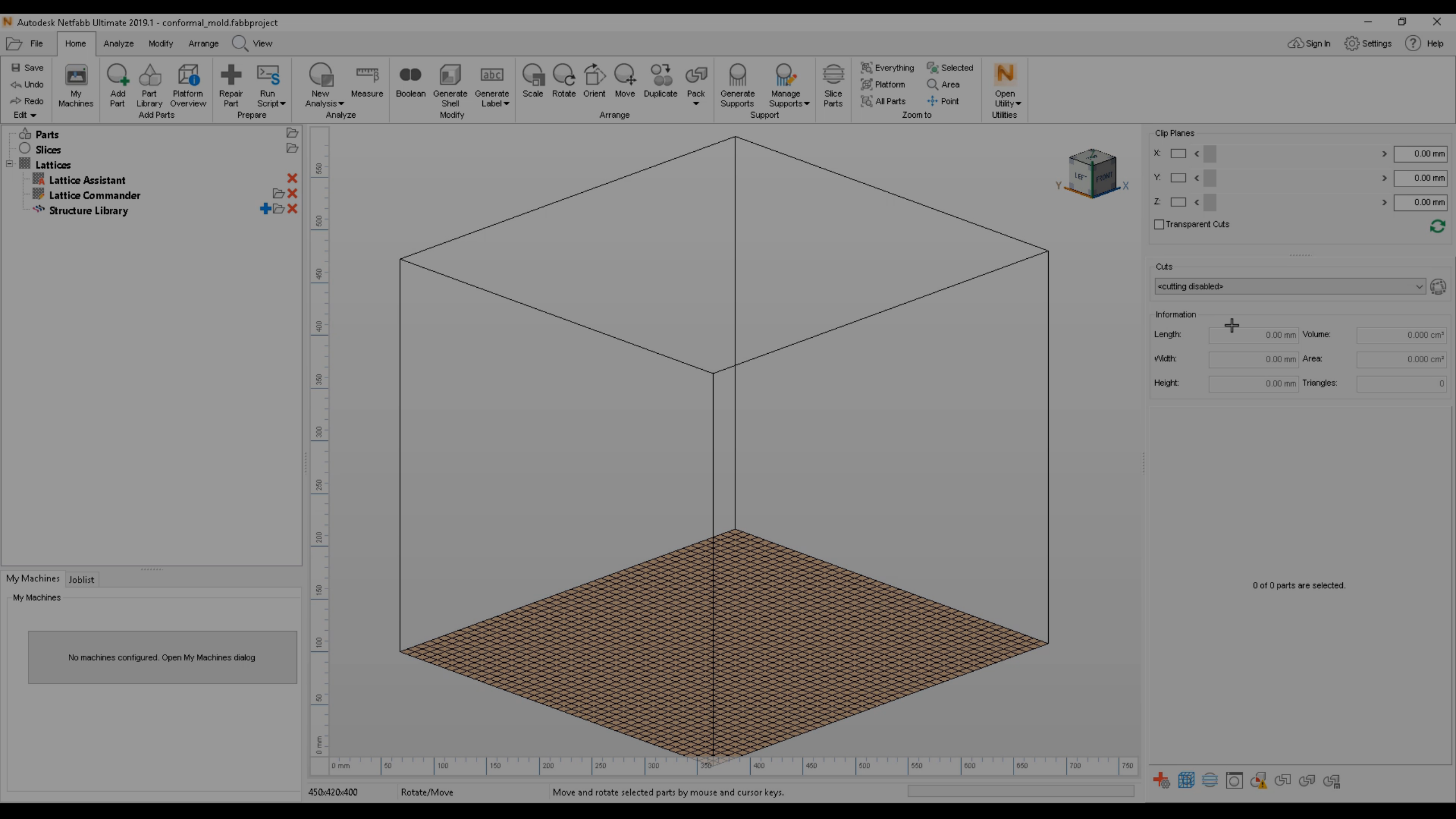


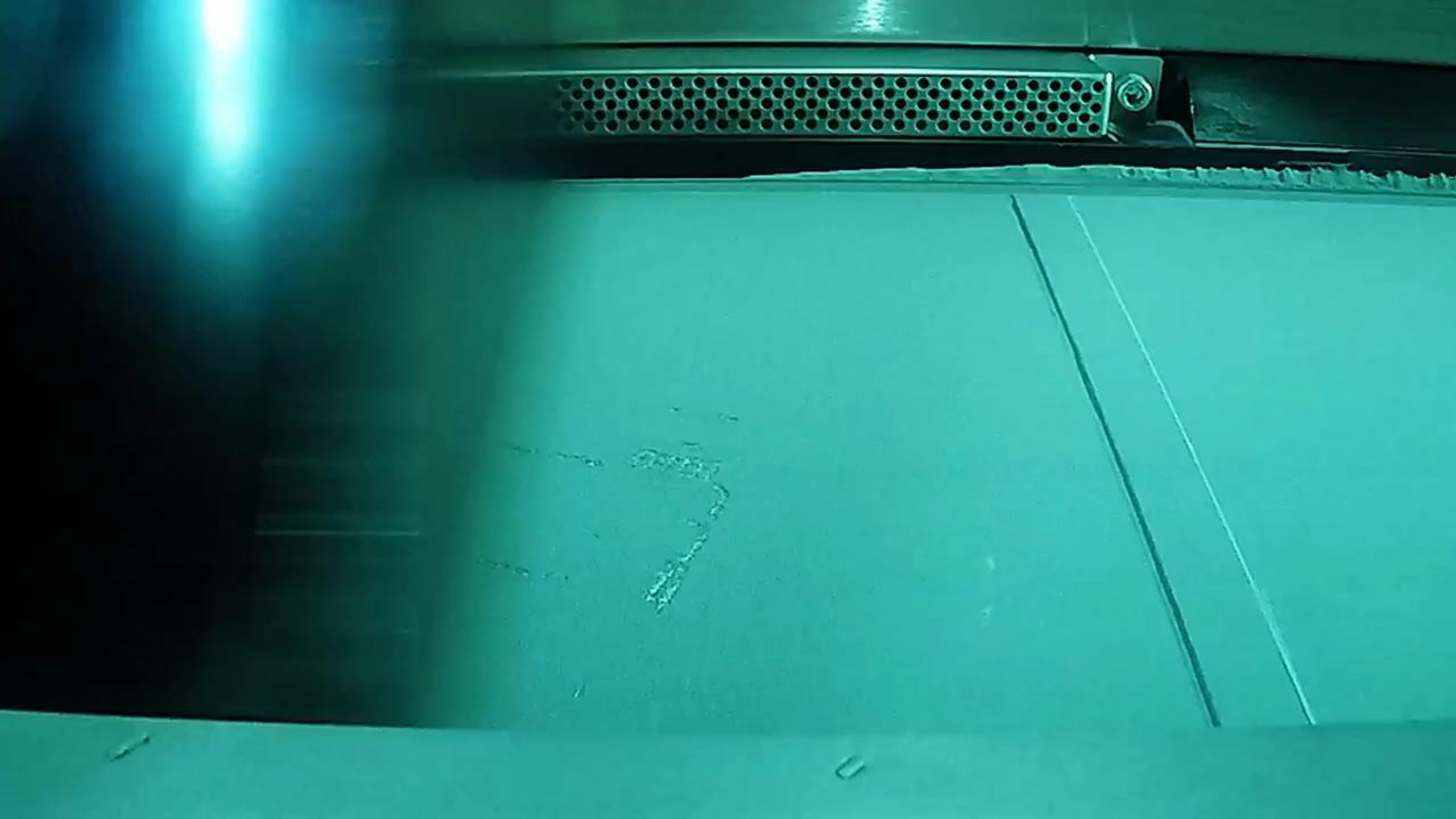
AUTODESK® FUSION 360™

AUTODESK® MOLDFLOW®

AUTODESK® NETFABB®

Subtractive Machining


Autodesk Netfabb Ultimate 2019.1 - conformal_mold.fabbproject
File
Home
Analyze
Modify
Arrange
View
Sign In
Settings
Help
Save
Undo
Redo
Edit
My Machines
Add Part
Part Library
Platform Overview
Add Parts
Repair Part
Run Script
Prepare
New Analysis
Measure
Analyze
Boolean
Generate Shell
Generate Label
Modify
Scale
Rotate
Orient
Move
Duplicate
Pack
Arrange
Generate Supports
Manage Supports
Support
Slice Parts
Everything
Selected
Platform
Area
All Parts
Point
Zoom to
Open Utility
Utilities
Parts
Slices
Lattices
Lattice Assistant
Lattice Commander
Structure Library
My Machines
Joblist
My Machines
No machines configured. Open My Machines dialog
Clip Planes
X:
Y:
Z:
0.00 mm
Transparent Cuts
Cuts
<cutting disabled>
Information
Length:
Width:
Height:
Volume:
Area:
Triangles:
0 of 0 parts are selected.
0 mm
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
450x420x400
Rotate/Move
Move and rotate selected parts by mouse and cursor keys.



Simulation Utility for Netfabb 2019.1

Edit Window Help

divy.tiwary

Home Results View Help

Step Backward | Play x2 | Step Forward | Loop | Time: 1963139.00 (s) | Increment: 72 | Z Height: 1.000 (mm) | Layer: 1

Animation

Standard | Banding | Contour | Legend | Plot Settings | View Logs | Record

Display

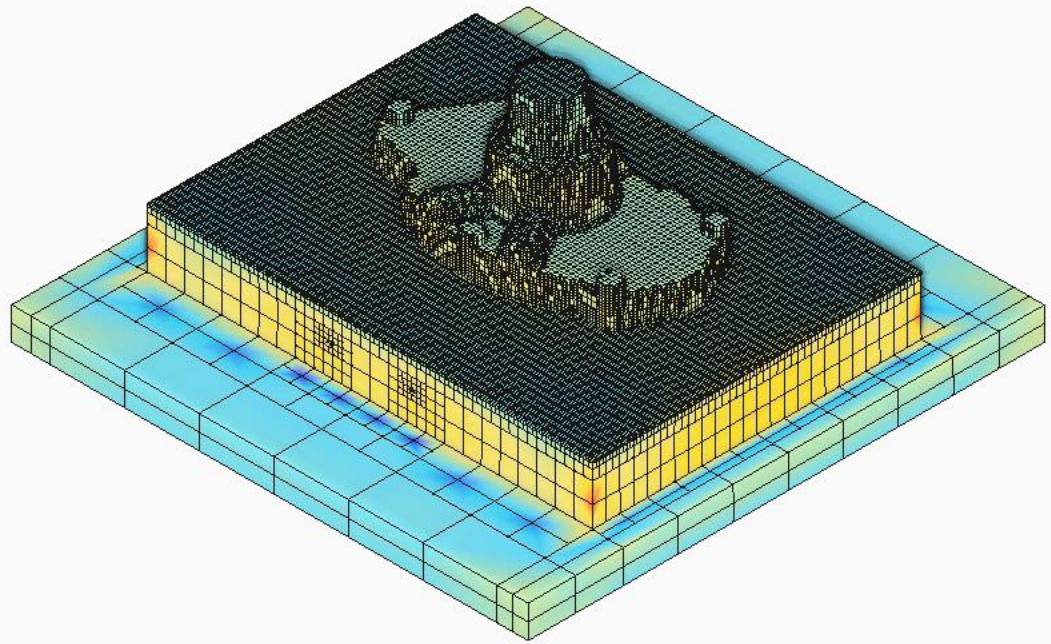
Select Visible | Table | Maximum | Minimum

Selection

Warped STL

Export

- conformal1_1.tivus (Powder bed fusion)
  - Geometry
    - waterpump_conformal mold_final.stl
      - MS1_divy
  - Build plate
    - SAE 304
  - Outline
  - Results
    - Mesh preview
      - Nodes: 135425
      - Layer-Nodes: 2573075
      - Elements: 75265
    - Cauchy stress
    - Displacement
    - Elastic strain
    - Equivalent plastic strain
    - Global recoater clearance %
    - Global recoater status
    - Plastic strain
    - Principal stress direction
    - Principal stress
    - Recoater clearance %
    - Recoater status
    - Structure type
    - Temperature
    - von Mises stress
  - Named Views



Displacement, Z (mm)

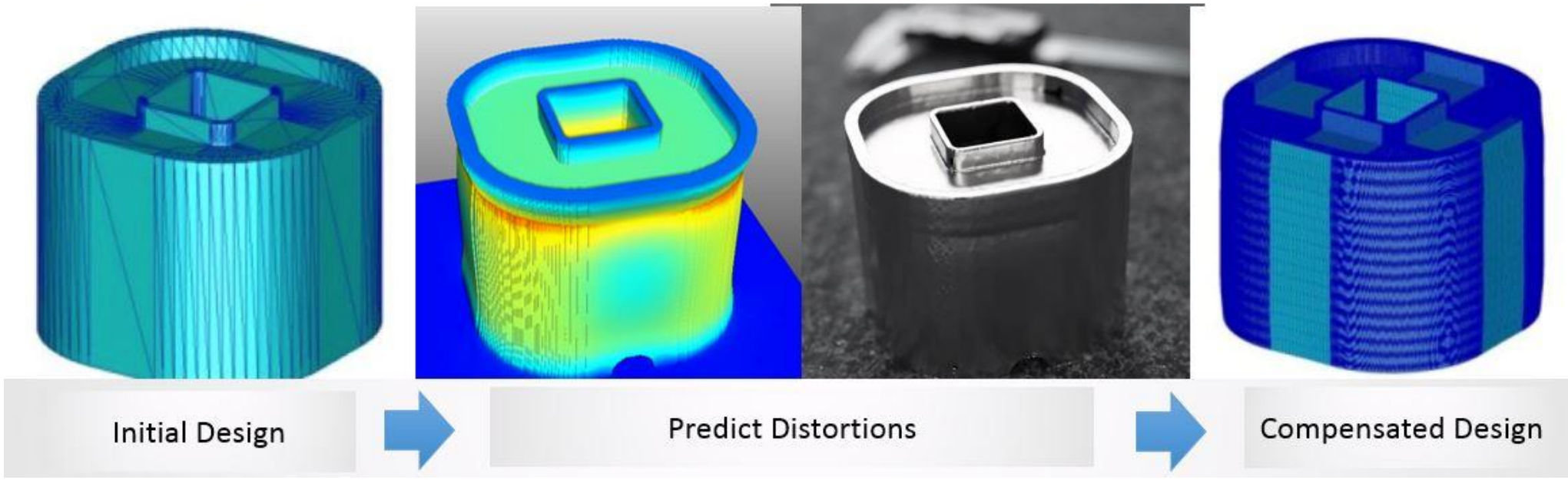
4.7622e-01
2.8523e-01
9.4250e-02
-9.6736e-02
-2.8772e-01

AUTODESK SIMULATION UTILITY FOR NETFABB

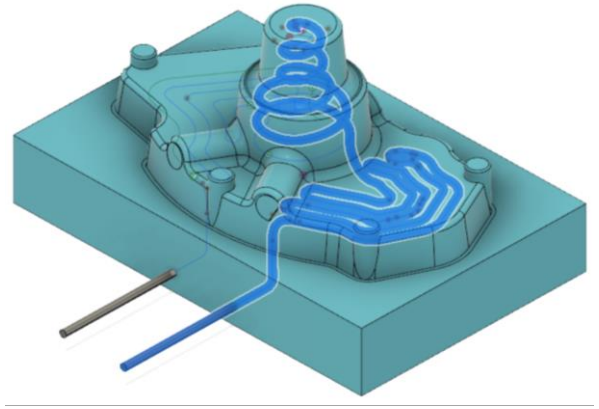
conformal1_1.tivus | conformal.tivus *

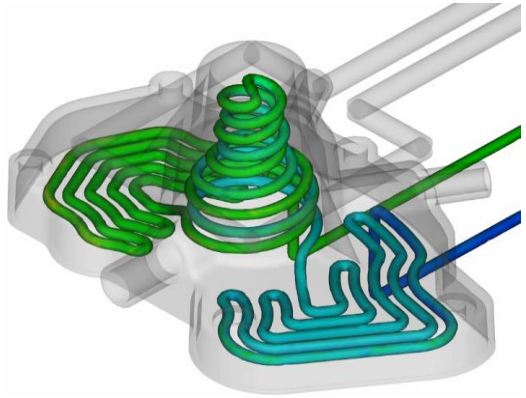
Successful

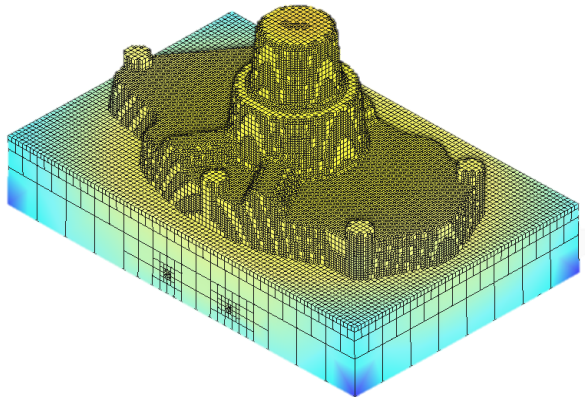
Additive Warpage Compensation

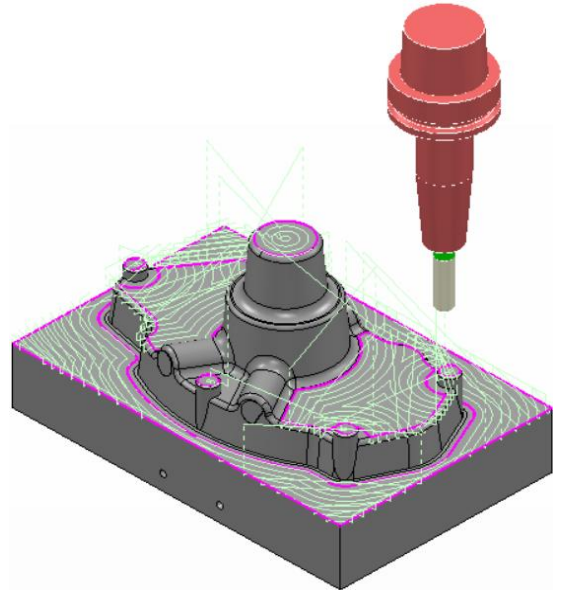


Injection Molding with Conformal Cooling









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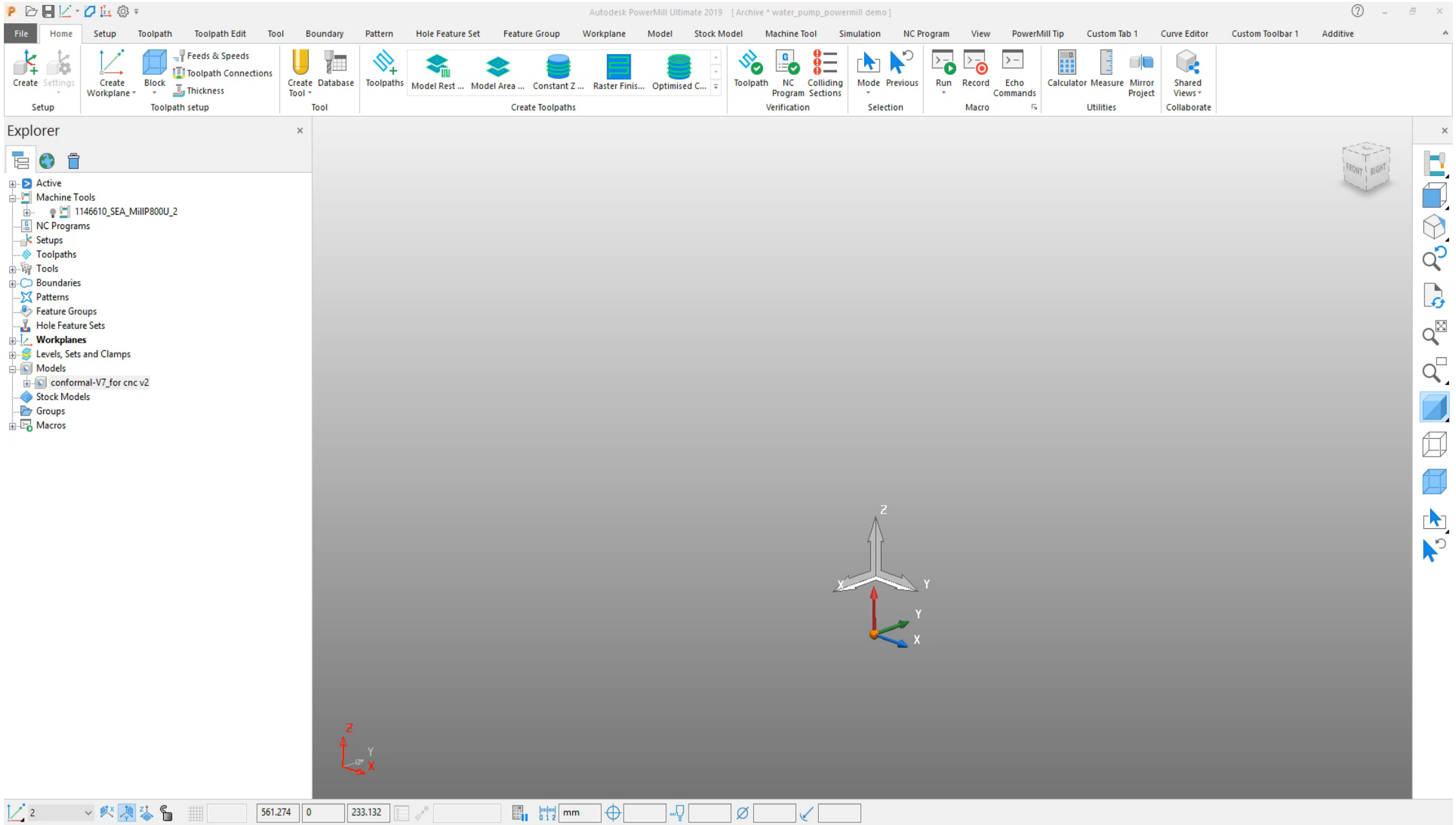
AUTODESK® POWERMILL®


Autodesk PowerMill Ultimate 2019 [Archive * water_pump_powermill demo]
File
Home
Setup
Toolpath
Toolpath Edit
Tool
Boundary
Pattern
Hole Feature Set
Feature Group
Workplane
Model
Stock Model
Machine Tool
Simulation
NC Program
View
PowerMill Tip
Custom Tab 1
Curve Editor
Custom Toolbar 1
Additive
Create
Settings
Setup
Create Workplane
Block
Feeds & Speeds
Toolpath Connections
Thickness
Toolpath setup
Create Tool
Database
Tool
Toolpaths
Model Rest ...
Model Area ...
Constant Z ...
Raster Finis...
Optimised C...
Create Toolpaths
Toolpath
NC Program
Colliding Sections
Verification
Mode
Previous
Selection
Run
Record
Echo Commands
Macro
Calculator
Measure
Mirror Project
Utilities
Shared Views
Collaborate
Explorer
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Machine Tools
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NC Programs
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Workplanes
Levels, Sets and Clamps
Models
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Stock Models
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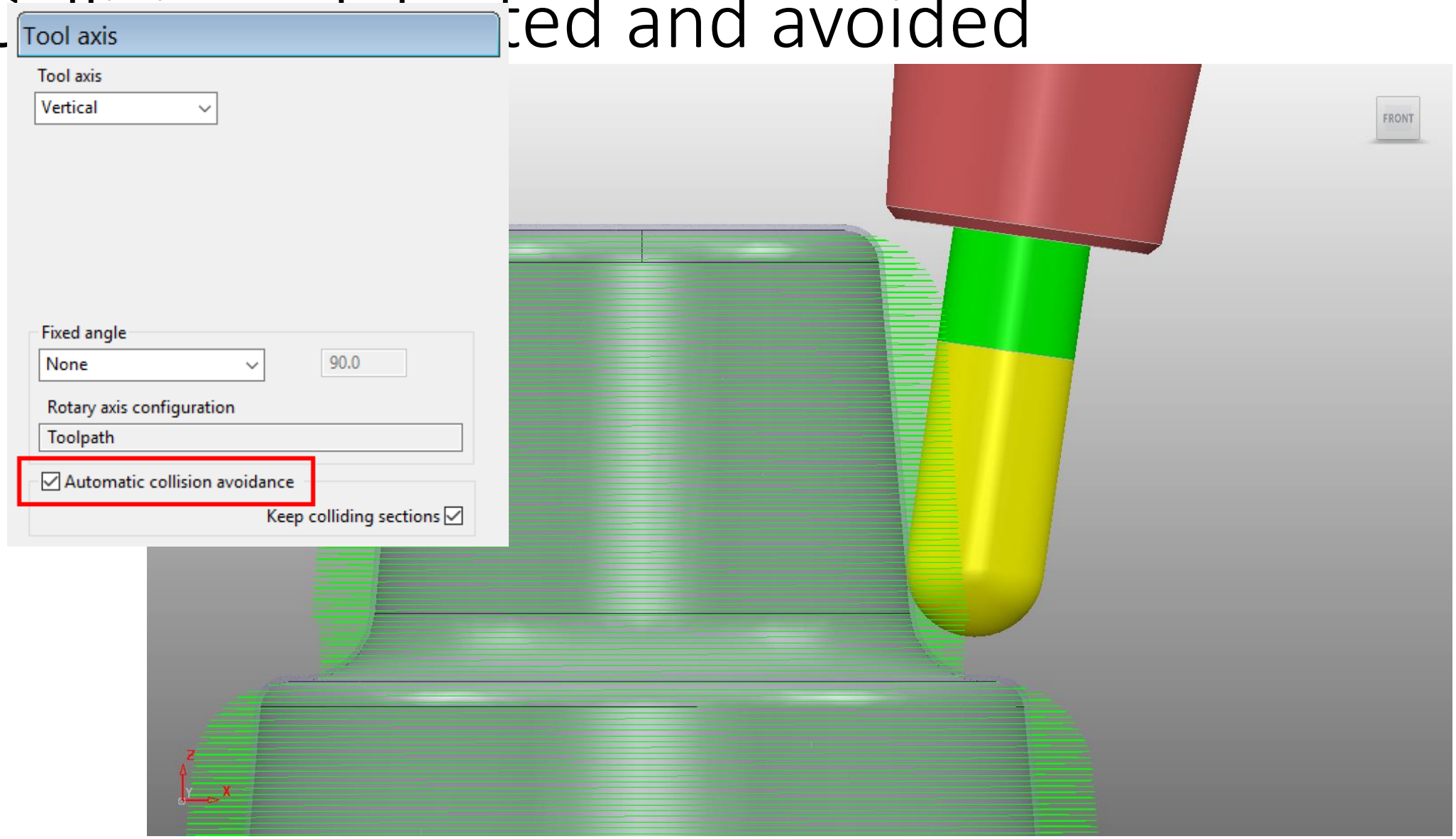

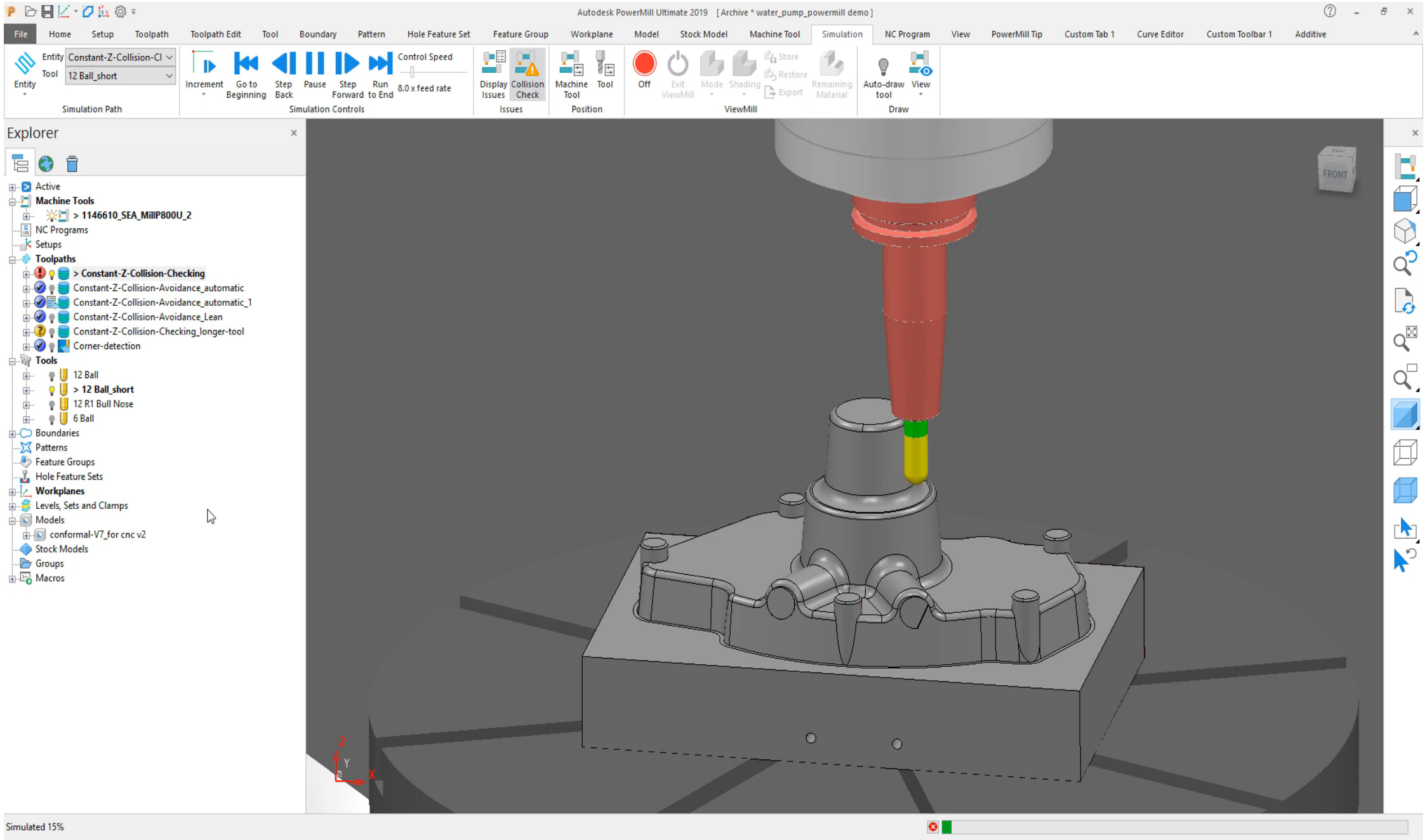
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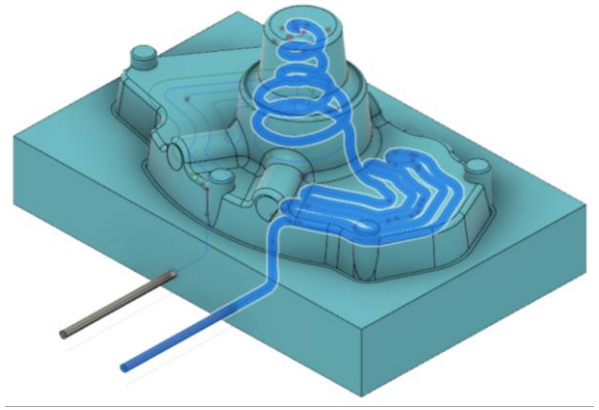
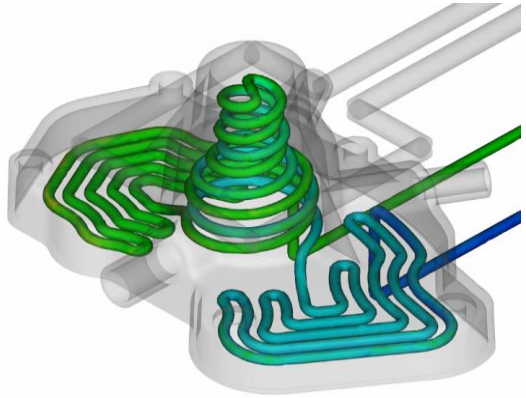
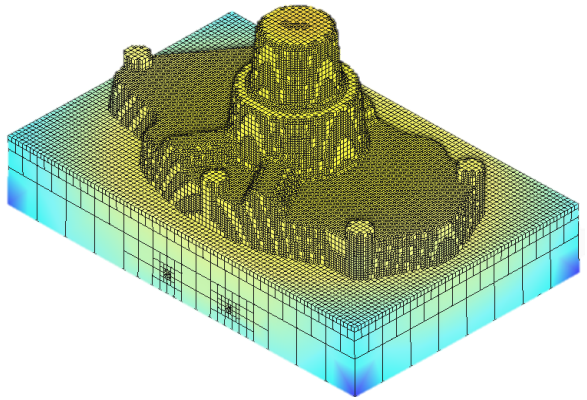
View
PowerMill Tip
Custom Tab 1
Curve Editor
Custom Toolbar 1
Additive
Entity
Constant-Z-Collision-Cl
Tool
12 Ball_short
Simulation Path
Increment
Go to Beginning
Step Back
Pause
Step Forward
Run to End
Control Speed
8.0 x feed rate
Simulation Controls
Display Issues
Collision Check
Issues
Machine Tool
Tool
Position
Off
Exit ViewMill
Mode
Shading
Store
Restore
Export
Remaining Material
ViewMill
Auto-draw tool
View
Draw
Explorer
Active
Machine Tools
> 1146610_SEA_MillP800U_2
NC Programs
Setups
Toolpaths
> Constant-Z-Collision-Checking
Constant-Z-Collision-Avoidance_automatic
Constant-Z-Collision-Avoidance_automatic_1
Constant-Z-Collision-Avoidance_Lean
Constant-Z-Collision-Checking_longer-tool
Corner-detection
Tools
12 Ball
> 12 Ball_short
12 R1 Bull Nose
6 Ball
Boundaries
Patterns
Feature Groups
Hole Feature Sets
Workplanes
Levels, Sets and Clamps
Models
conformal-V7_for cnc v2
Stock Models
Groups
Macros
FRONT
Simulated 15%

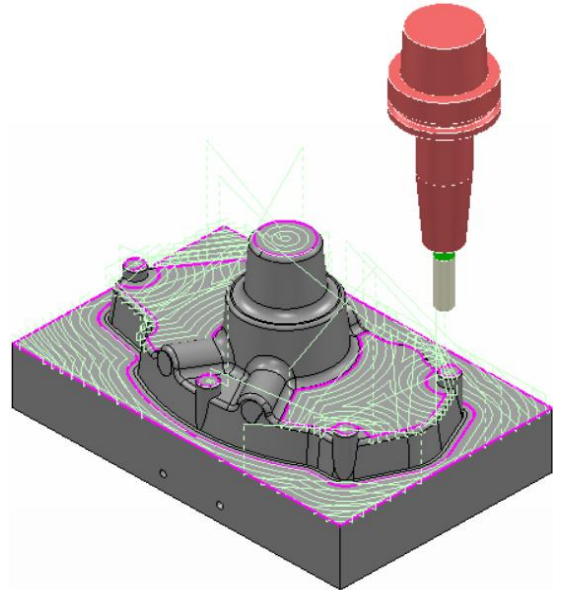
Innovation Workflow

Overview









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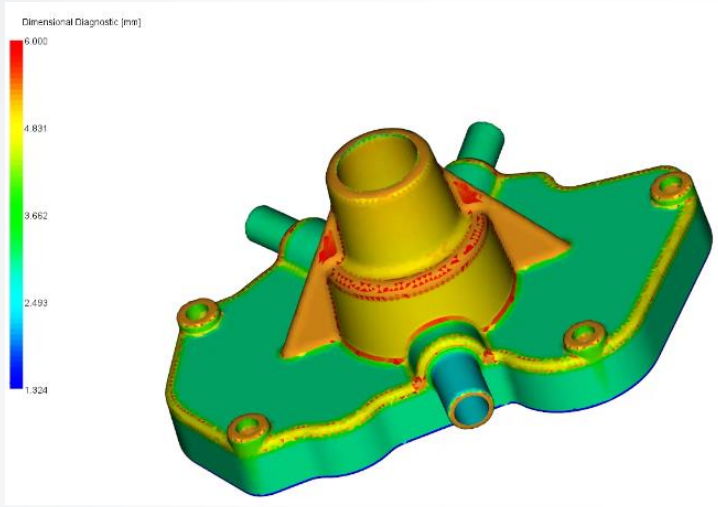
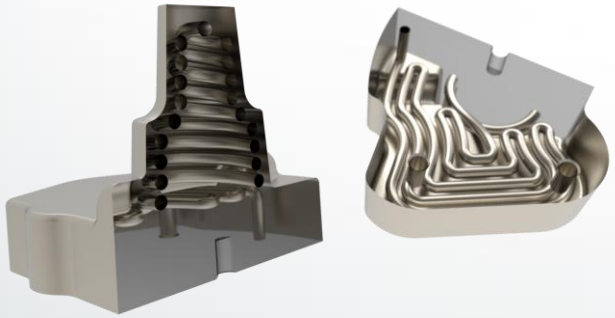
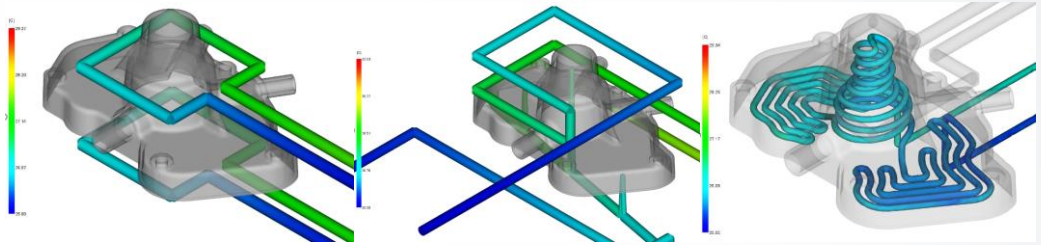
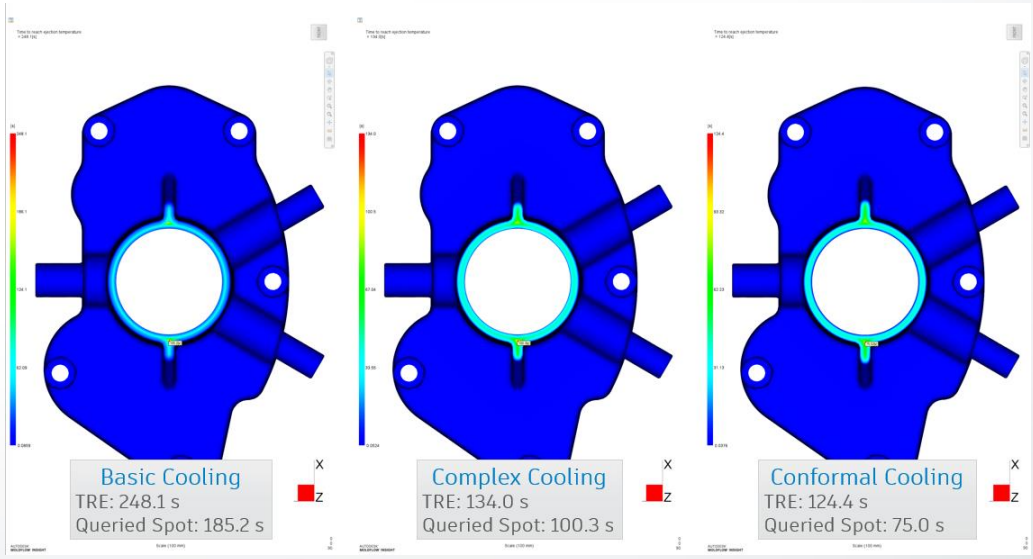
Mould Cooling Options – Water Pump Housing





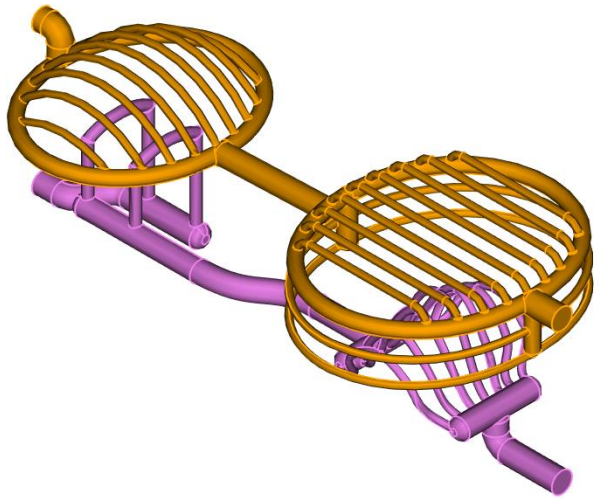


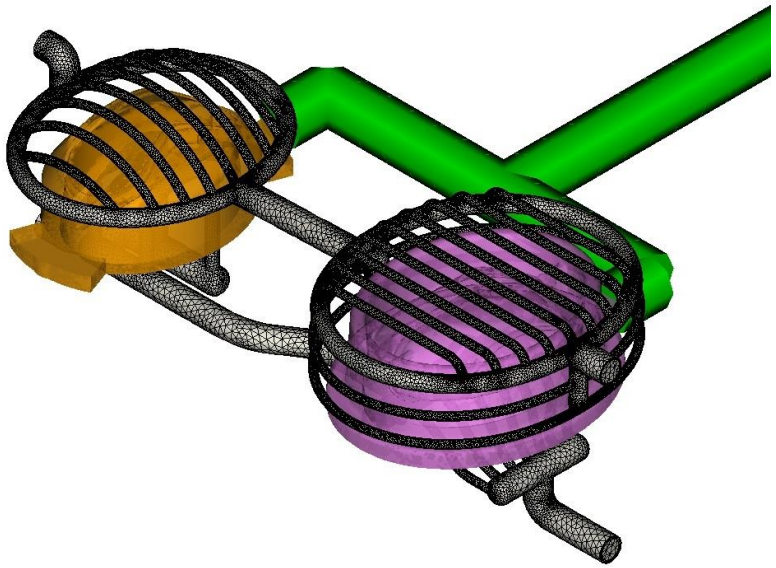


Study of Conventional and Conformal Cooling Systems on 3D Printed Injection Mold Tooling

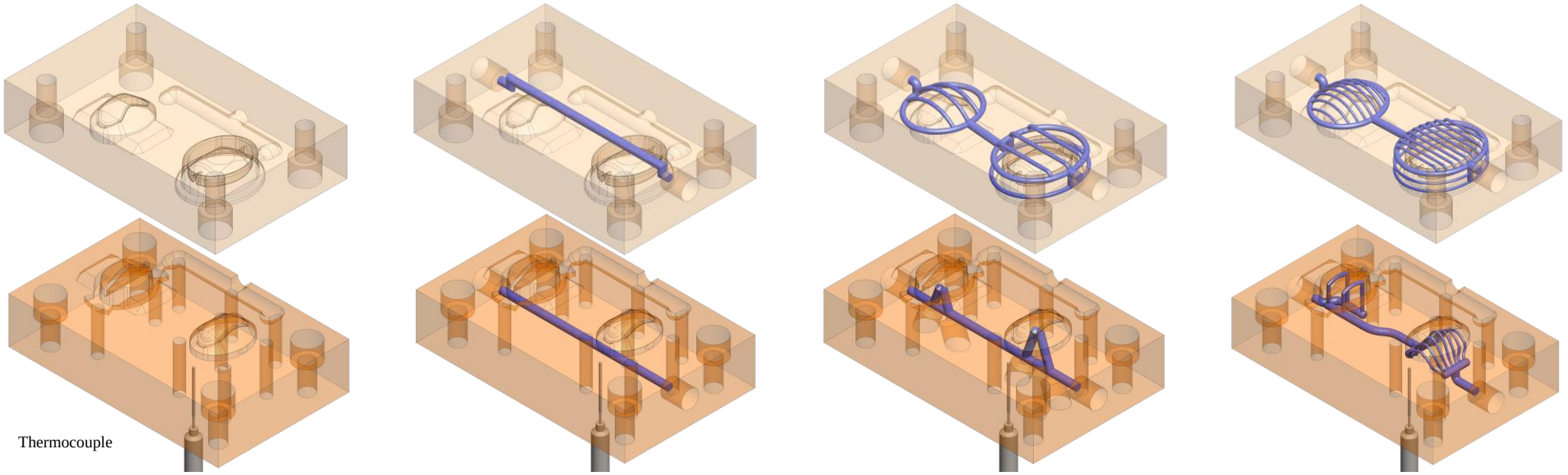
Stephen Johnston, Ph.D
Associate Professor, UMass Lowell

Gabriel Mendible, Ph.D.
Moldflow Engineer, MPC, Inc.





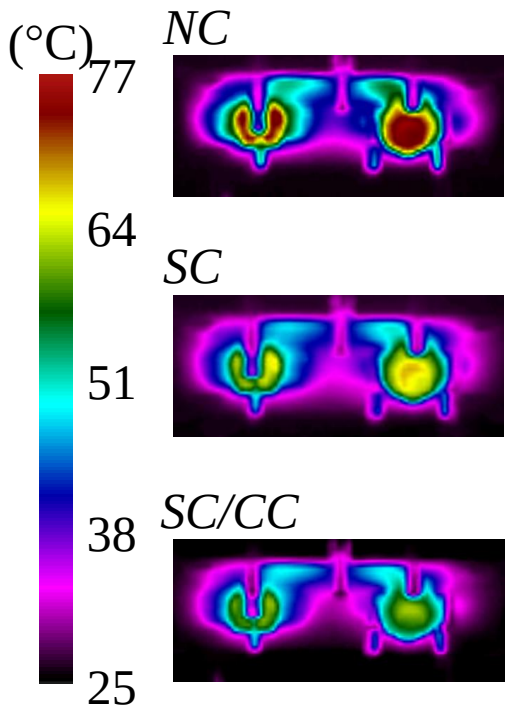
Cooling System Designs



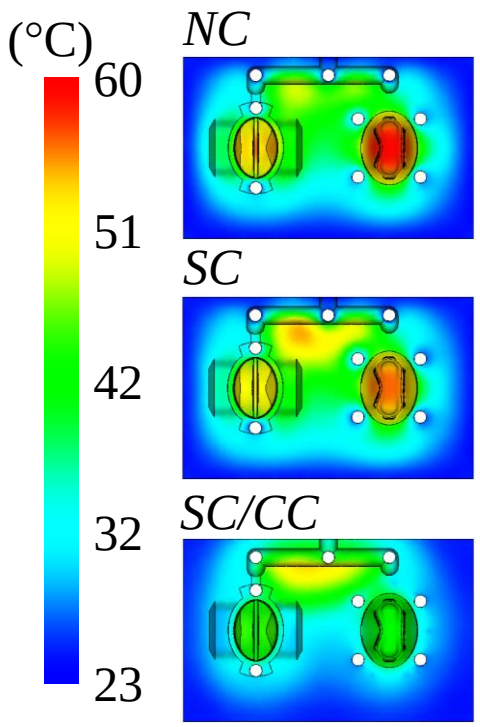
Results - Temperature Gradient at Mold Closing

IR thermal images gradients correlate with simulated results

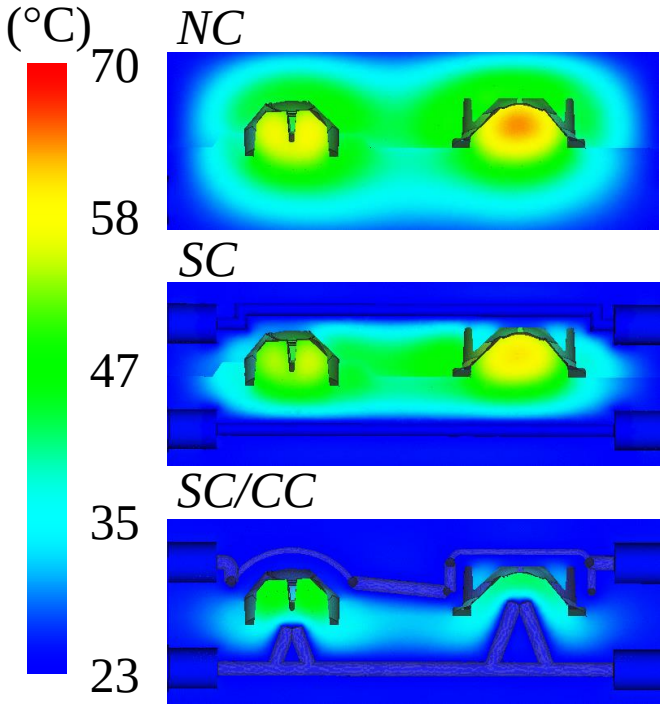
IR Thermal Images



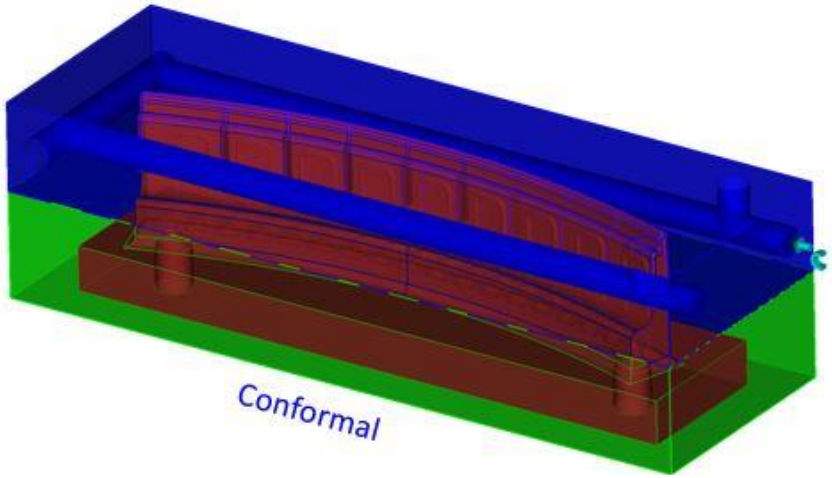
Simulation (B-side)

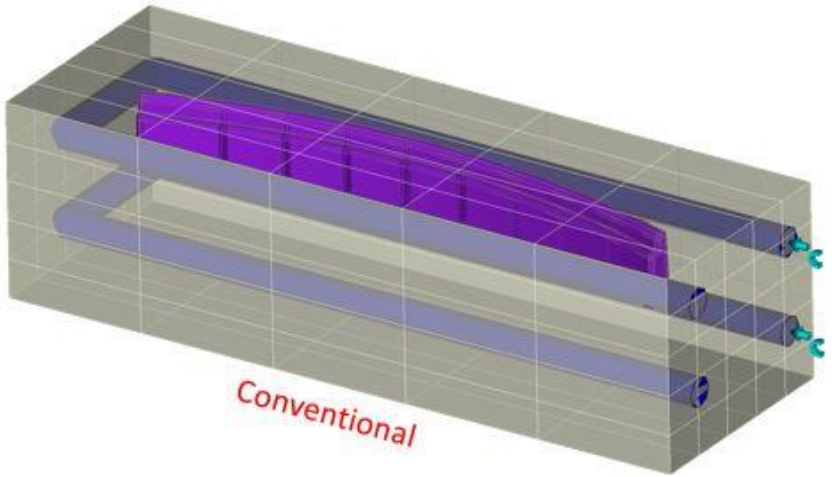


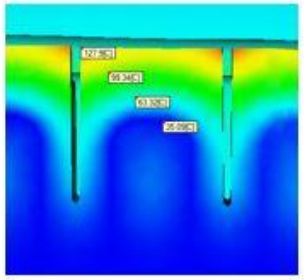
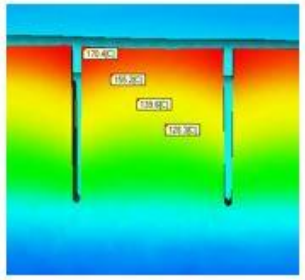
Simulation (cross section)



Conventional v Conformal

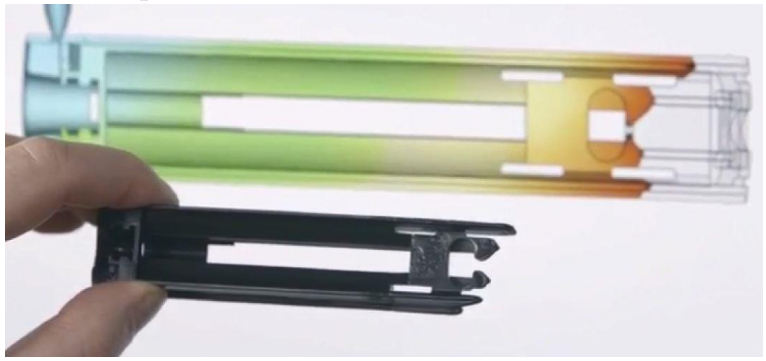


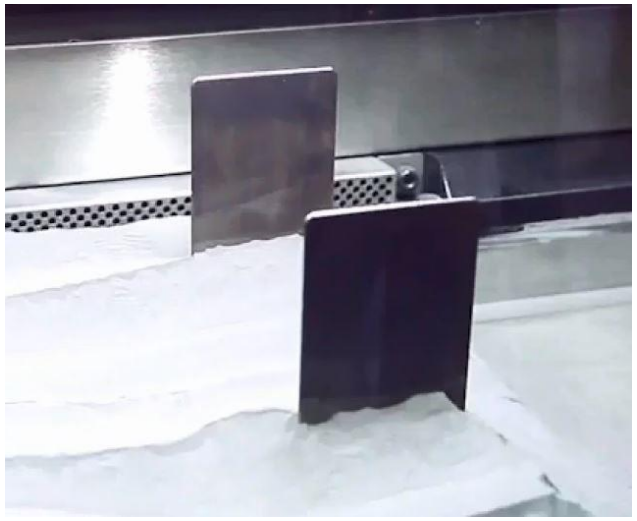


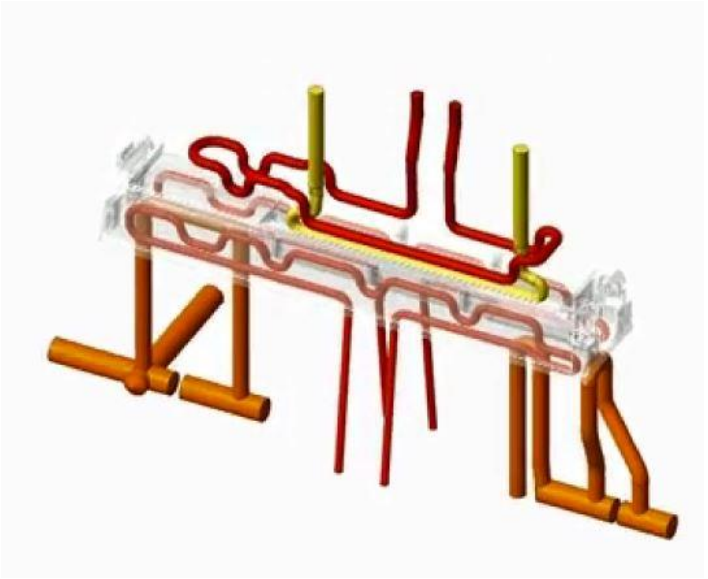
Conformal	Conventional
	

	Conformal	Conventional	Difference
Max. mold temperature	139°C	174°C	+35°C
Cycle time	8.3s	12.5s	4.2s (151%)
Cycles per hour	433	288	-145 (67%)

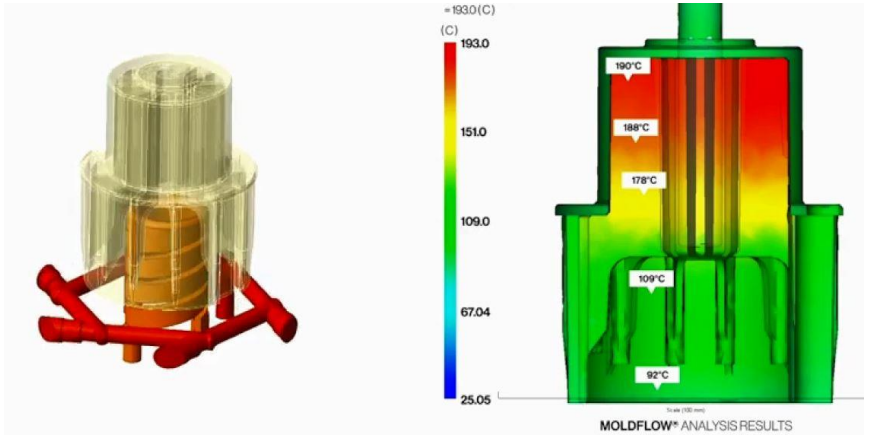
Customer Example -

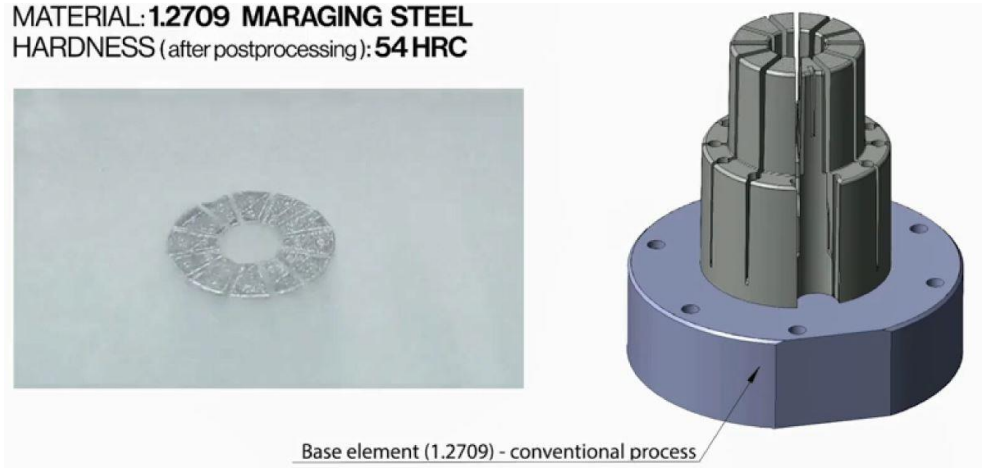


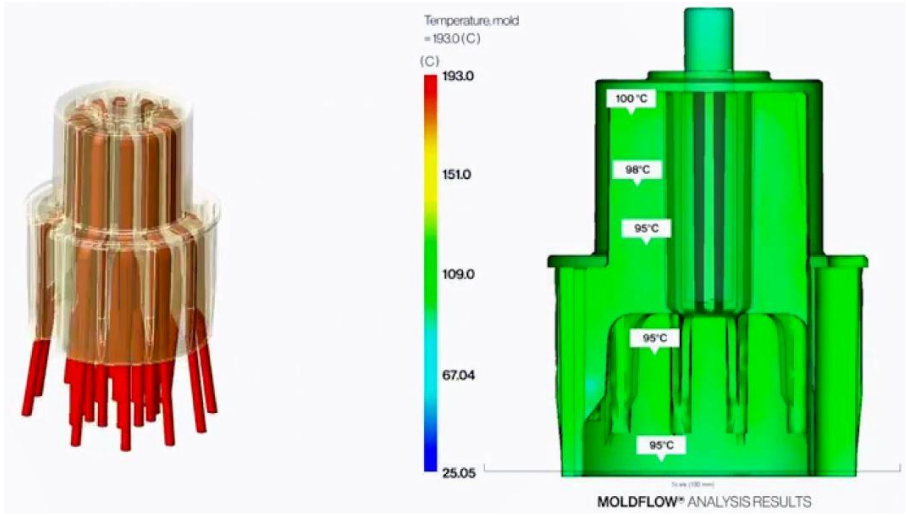


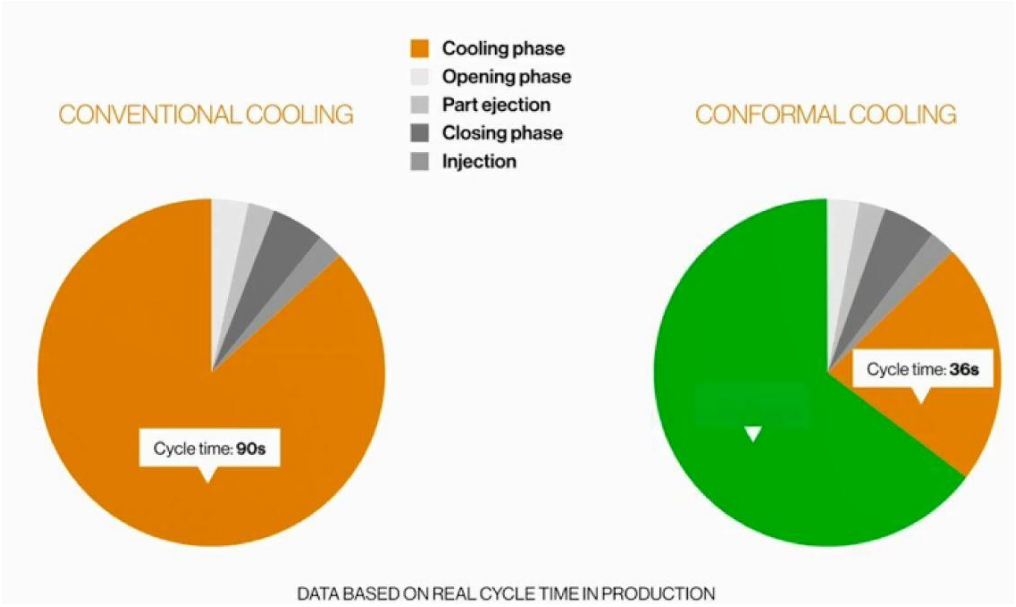


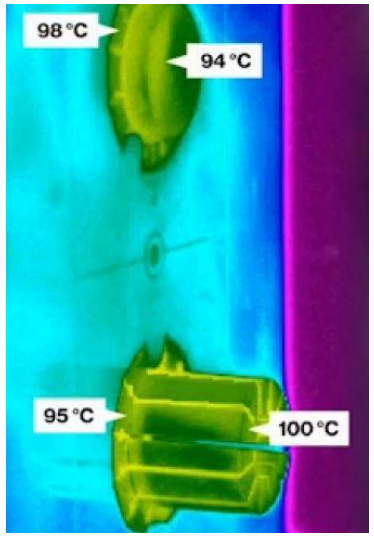
Customer Example - FADO



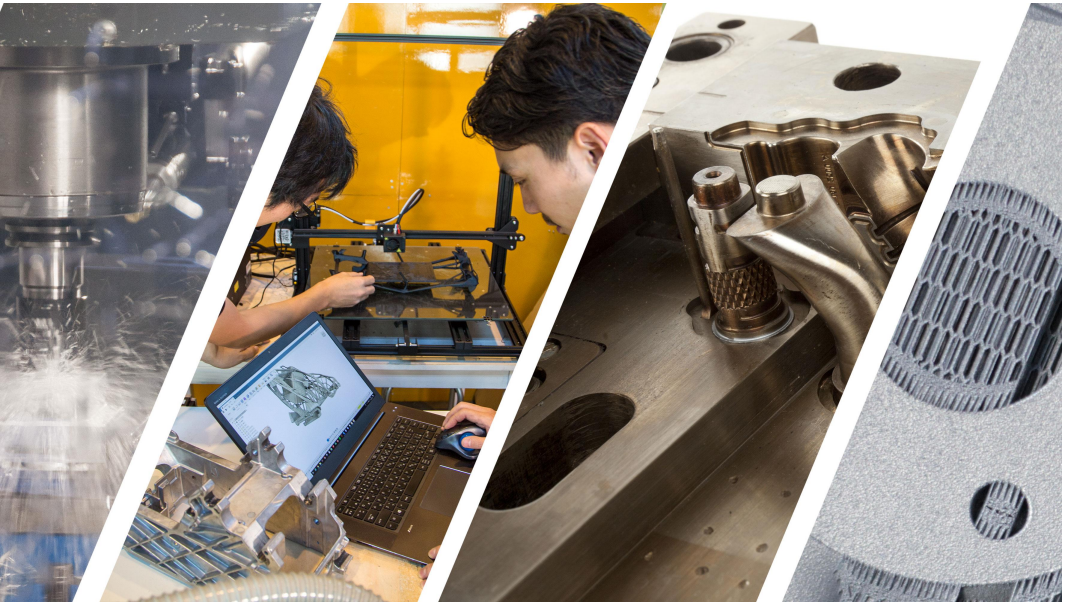


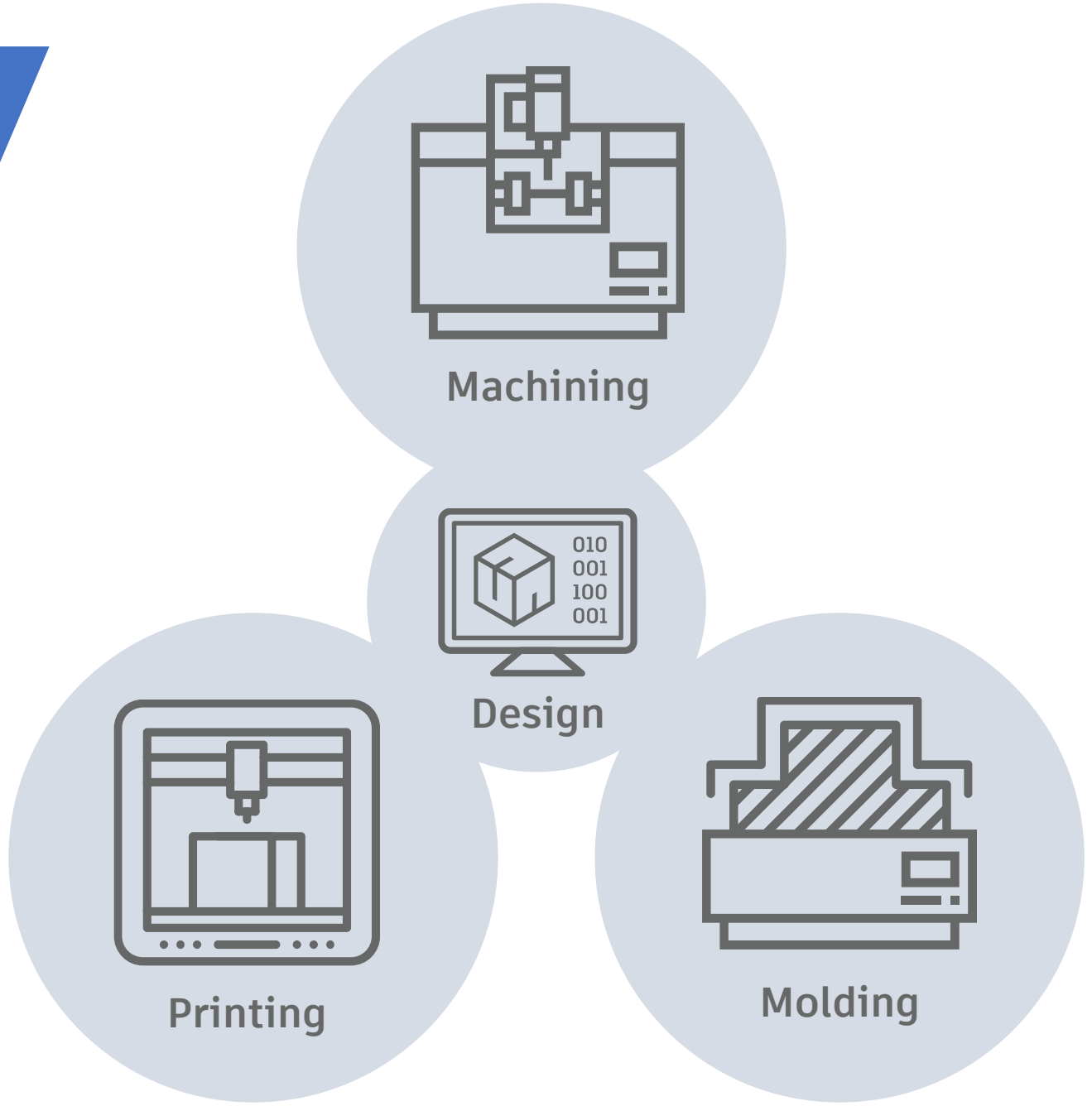




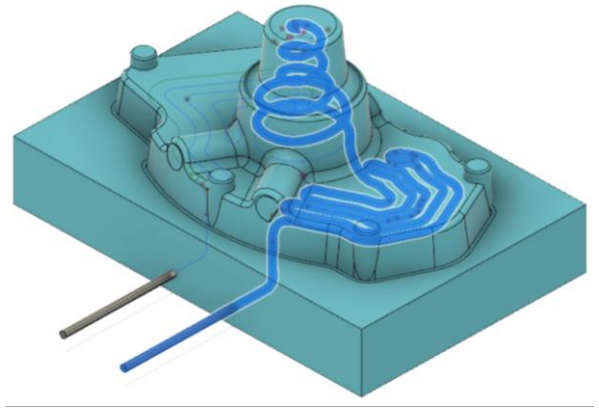


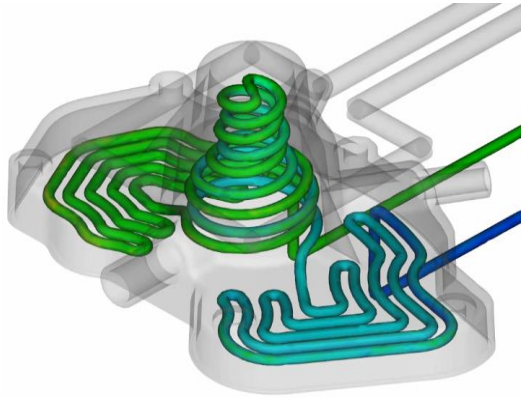
MANUFACTURING LED DESIGN

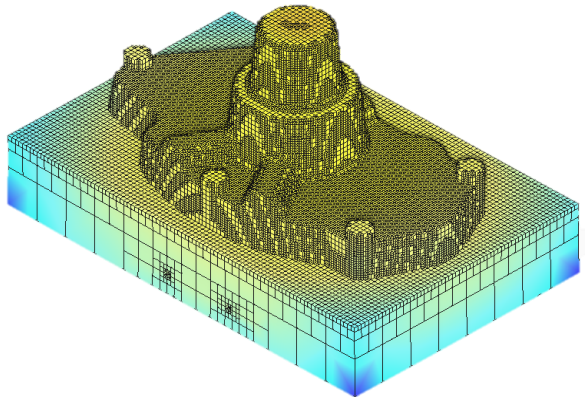


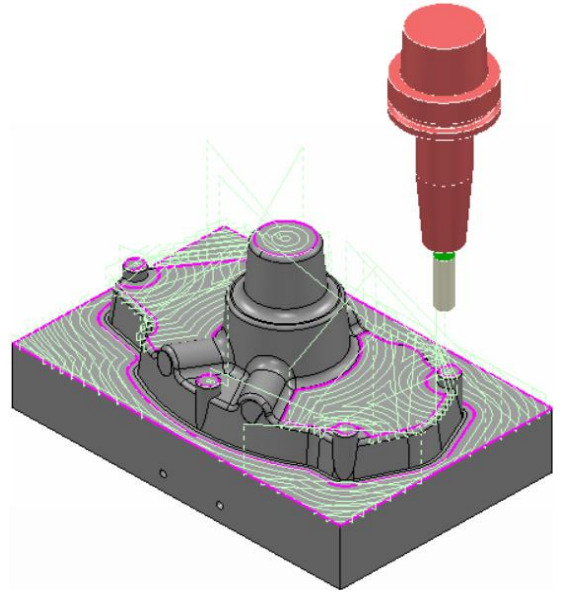


Injection Molding with Conformal Cooling









Part + Mold Design

Injection Molding Verification

Additive Manufacture

Subtractive Machining


What could we make together?

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Make anything™