



ADVANCED ENGINEERING s.r.o.

MECHANIKA A PROUDĚNÍ V MŘÍŽKOVÝCH A GYROIDNÍCH STRUKTURÁCH PRO ADITIVNÍ VÝROBU

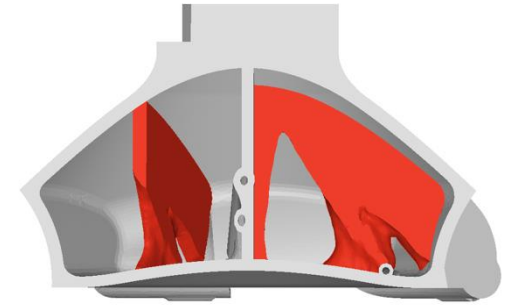
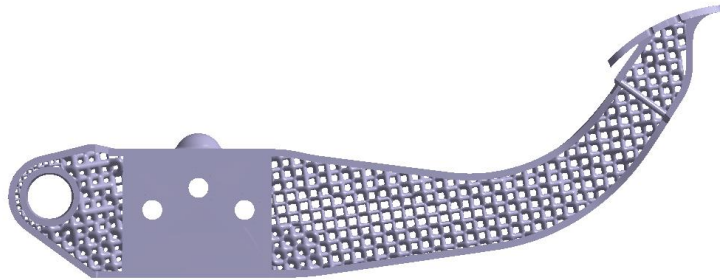
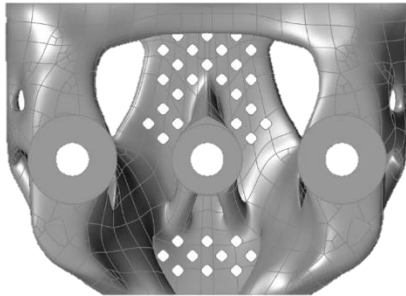
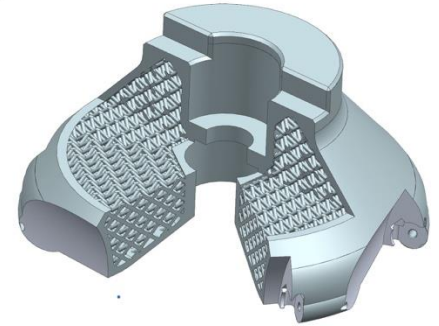
Vojtěch Rulc - Advanced Engineering s.r.o.

ADVANCED ENGINEERING TechDay 2026, 23. června 2026

OPTIMIZATION

R&D PROJECTS

- Precise simulation enables lightweighting optimization
- Usually 10 - 30 % weight saving
- Taking account of manufacturing limits (overhangs)
- Unique lattice optimization
- Unique extremely fast simulations on lattice structures

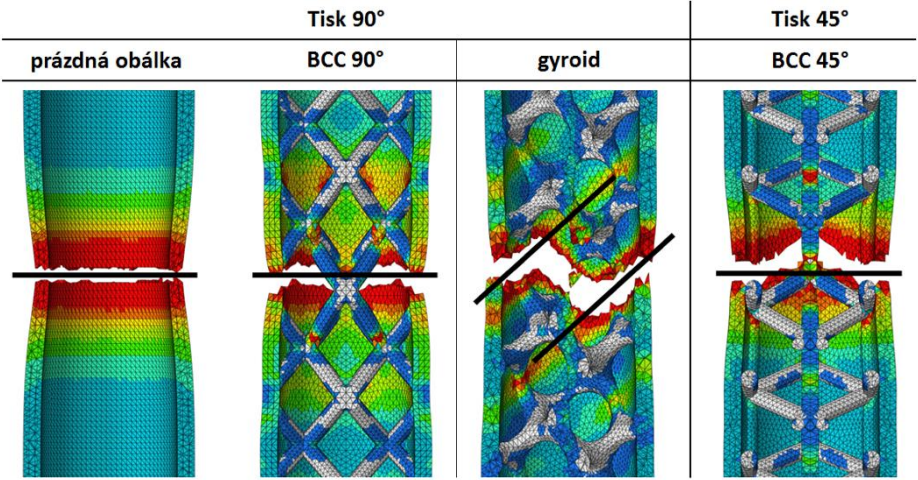
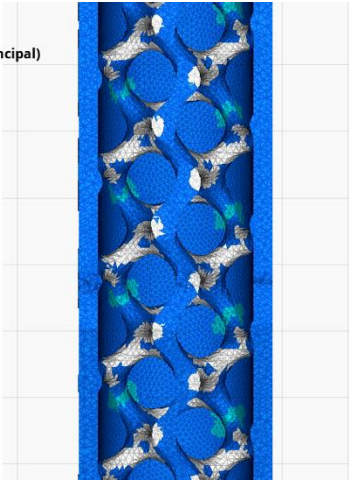


ADITIVE MANUFACTURED MATERIALS

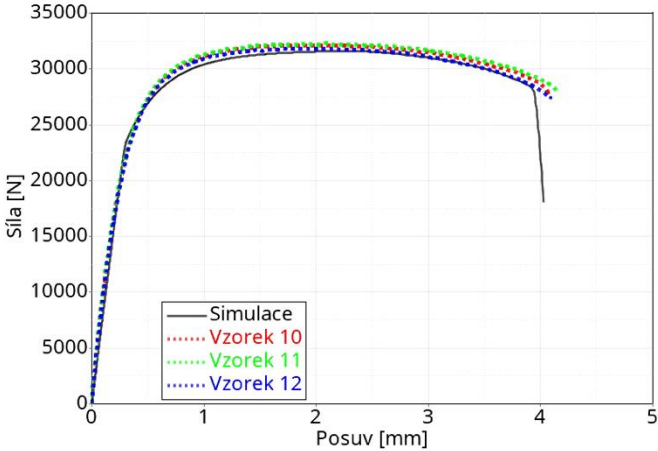
R&D PROJECTS

Contour Plot
Strain(Absolute Max Principal)
Elemental system

- 0.782
- 0.300
- 0.257
- 0.214
- 0.171
- 0.129
- 0.086
- 0.043
- 0.000
- 0.706
- No Result

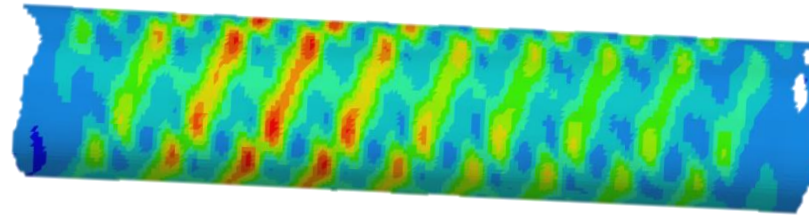
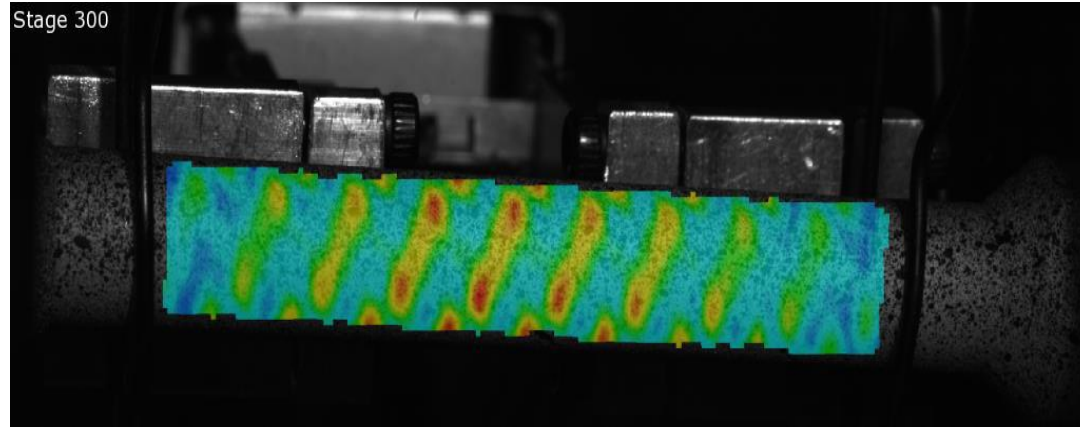


Deformační křivka



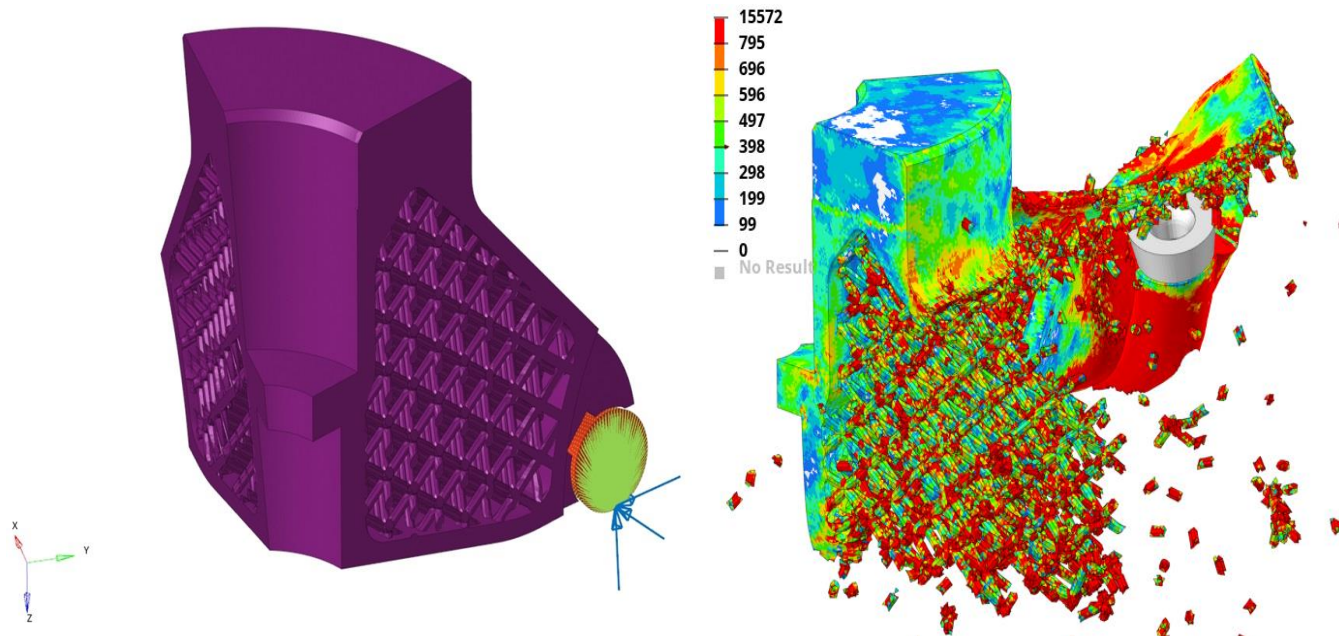
ADITIVE MANUFACTURED MATERIALS

R&D PROJECTS



ADITIVE MANUFACTURED MATERIALS

R&D PROJECTS

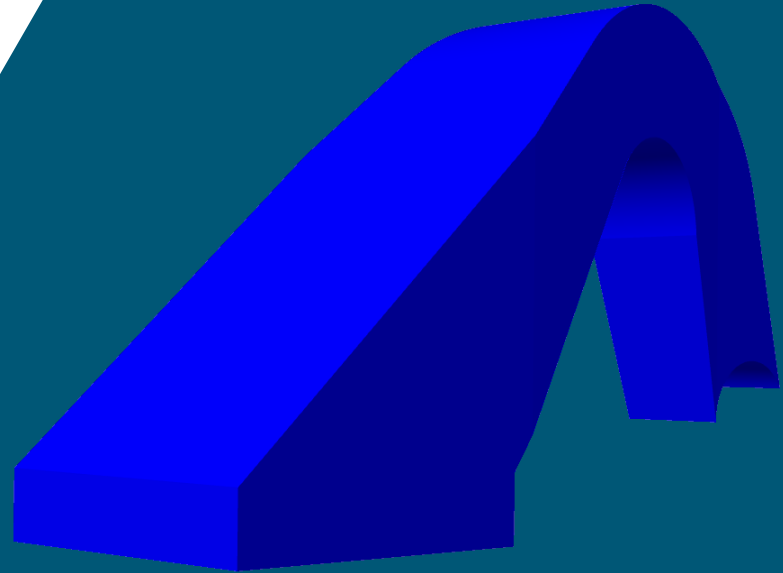


IMPLICITNÍ GEOMETRIE V SIMCENTER INSPIRE

IMPLICIT MODELING

Overview

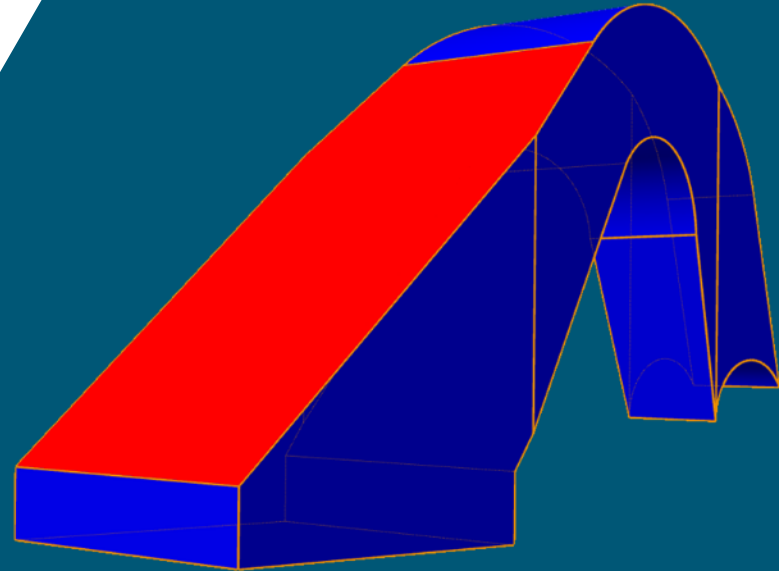
- Represents geometry using implicit functions, which can be thought of as a 3D field of scalar values
- Scalar values represent (notional) distance to the surface, with negative values on the inside and positive values on the outside of the volume
- Isosurface that passes through all positions in field where the scalar value is equal to a user-specified constant
- Efficiently and robustly manipulate complex geometry, perform Booleans and offsets without failure, and model at scale with a high resolution.



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*Traditional B-Rep part –
points, lines, surfaces, solids*

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*Implicit part –
3D fields of scalar values*

IMPLIC

Overview

- Represents a scalar field of values.
- Scalar values range from the minimum inside a volume to the maximum outside the volume.
- Isosurface extraction in field visualization is user-specified.
- Efficient geometric algorithms without high resolution.

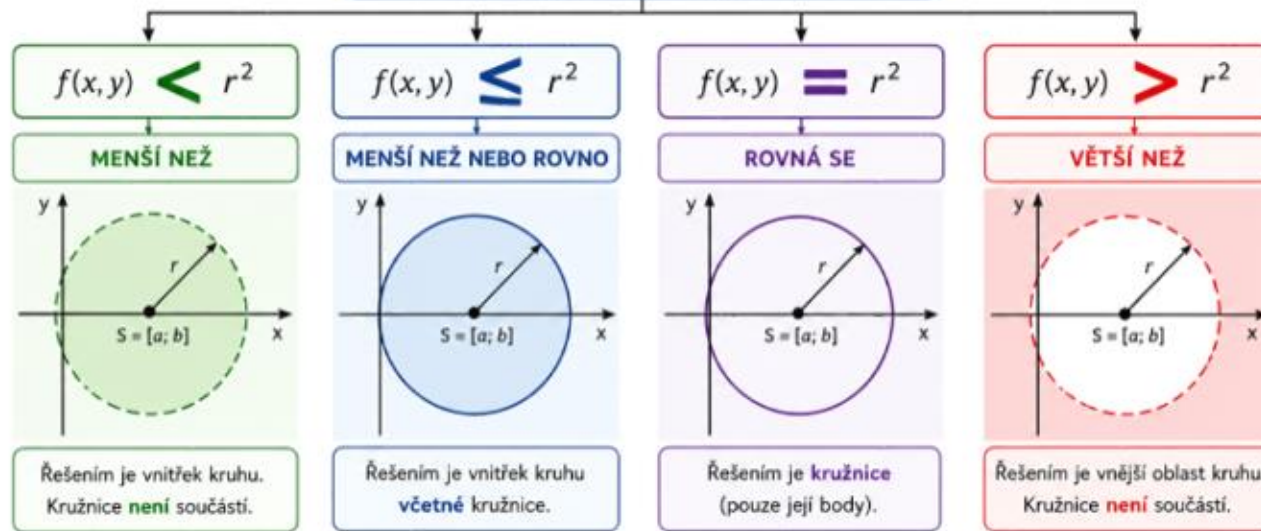
KRUH

Kruh se středem $S = [a; b]$ a poloměrem $r > 0$

ZÁKLADNÍ FUNKCE

$$f(x, y) = (x - a)^2 + (y - b)^2$$

vzdálenost bodu $[x; y]$ od středu $S = [a; b]$ umocněná na dvě



$S = [a; b]$... střed kruhu (souřadnice středu) $r > 0$... poloměr kruhu r ... poloměr (vzdálenost středu od kružnice)

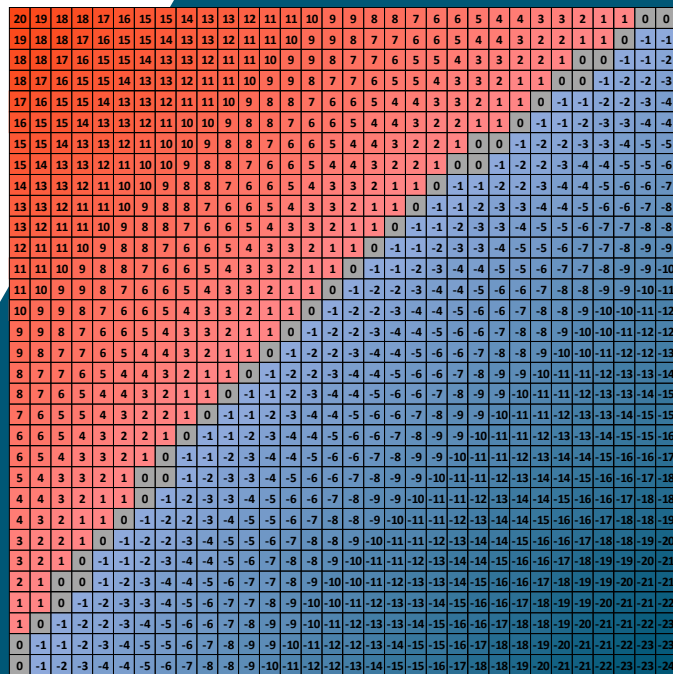


UD nodes of scalar values

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*Implicit part –
Surface is 0, positive scalars (outside),
negative scalars (inside)*

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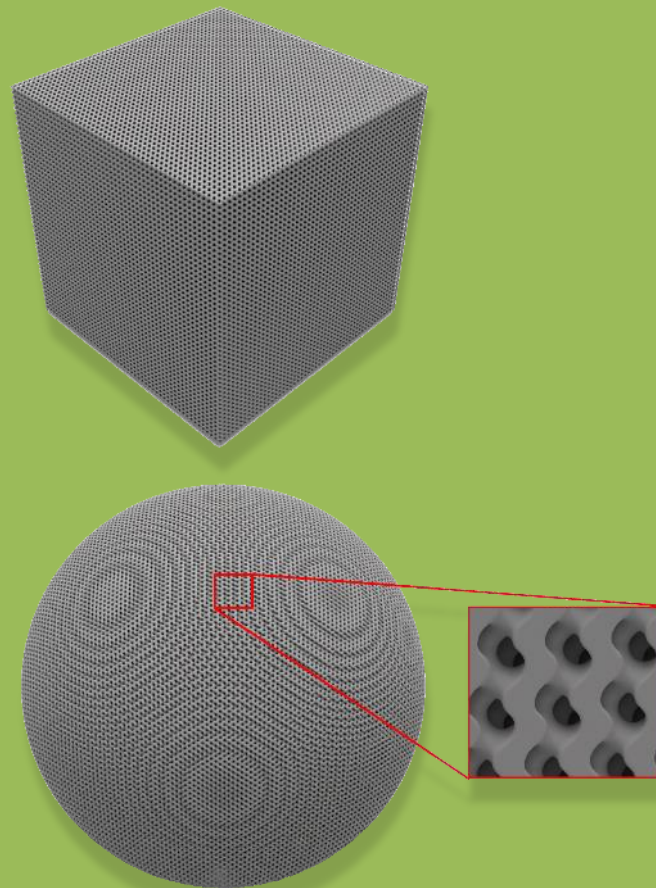
*Implicit part –
Offset surfaces are simple & robust*

ILLUSTRATIVE EXAMPLE

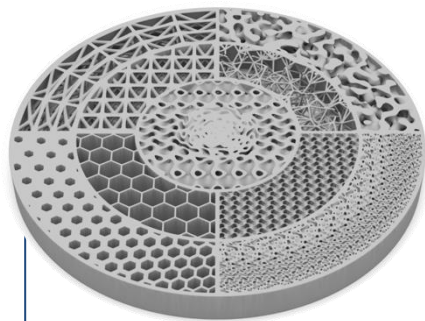
Efficiently generate complex structures with very high surface areas which would be impossible to model using traditional modeling tools.

- $64 \times 64 \times 64 = 262,144$ Gyroid unit cells
- Trim lattice to any other shape
- Can edit and view at interactive speeds
- This would require of the order 25-million NURBS patches to model!

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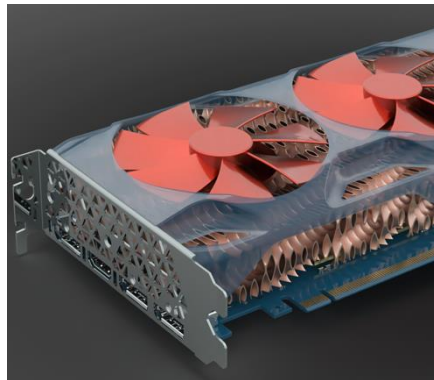
INSPIRE IMPLICIT MODELING



Familiar CAD Workflow

With construction history

Use any geometry representation with implicit modeling, taking full advantage of the construction history and flexible parameters control.

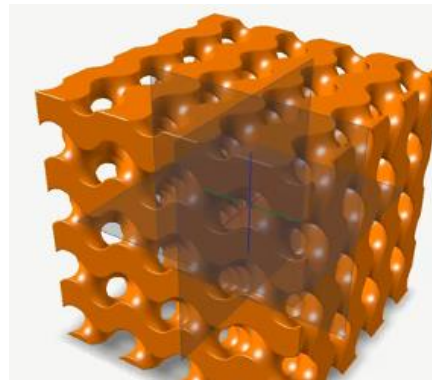


GPU Acceleration

For geometry creation & rendering

Real-time updates and slicing of highly complex implicit geometry, up to 900x faster than Sulis.

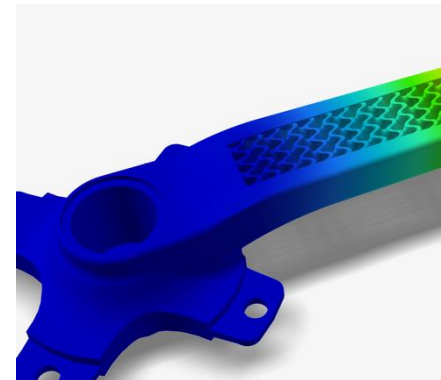
Native rendering with lighting and scenes.



Field-driven Design

Intuitive, flexible, powerful

Use reference geometries, B-rep features, implicit functions, point clouds, or the Python API to quickly control field parameters



Links to Altair Ecosystem

Simulate with SimSolid, Print3D

Seamless rapid structural analysis with Altair SimSolid,

Additive process feasibility with Inspire Print3D.

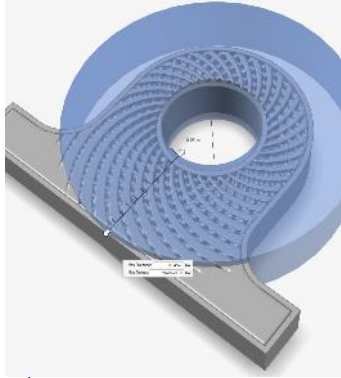
WHY SHOULD YOU CONSIDER INSPIRE FOR IMPLICIT GEOMETRIC MODELING?

- **Familiar** – Uses familiar mainstream CAD workflows with Construction History across all geometry representations.
- **Fast** – GPU acceleration for geometry creation and rendering
- **Flexible** – Intuitive and flexible field-driven design
- **Extensible** – Infinite extensibility through the Python API
- **Integrated** – works seamlessly jumping between B-Rep and Implicit representations. Links out to wider Altair Simulation ecosystem

Everything can be parameterized and field driven – Best tool for the conceptual design development of lattice-based structures

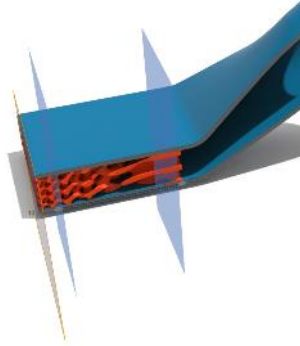


FIELD-DRIVEN DESIGN



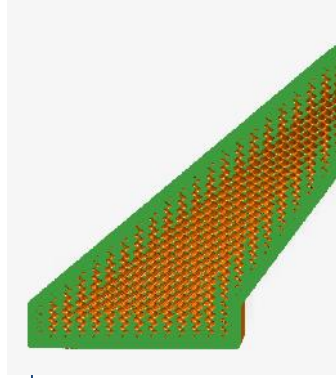
Reference Geometry

Planes, Axes,
Points
Use construction
geometry to
define specific
reference objects
to drive a field.



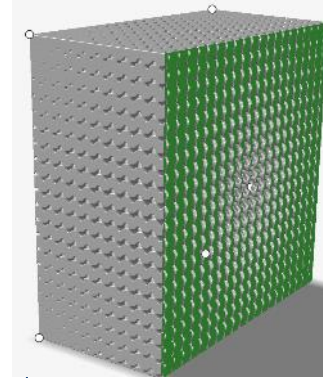
B-rep Features

Faces, Edges,
Vertices
Define fields
based on the
distance to
features on
regular b-rep
geometry.



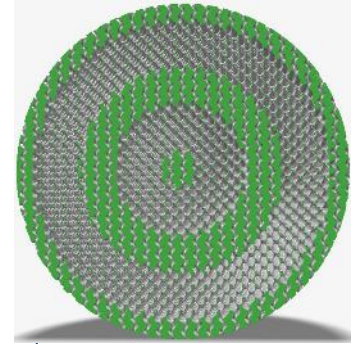
Implicit Functions

Geometry or
Function
Use any Implicit
body or function
to drive another
implicit parameter.



Point Clouds

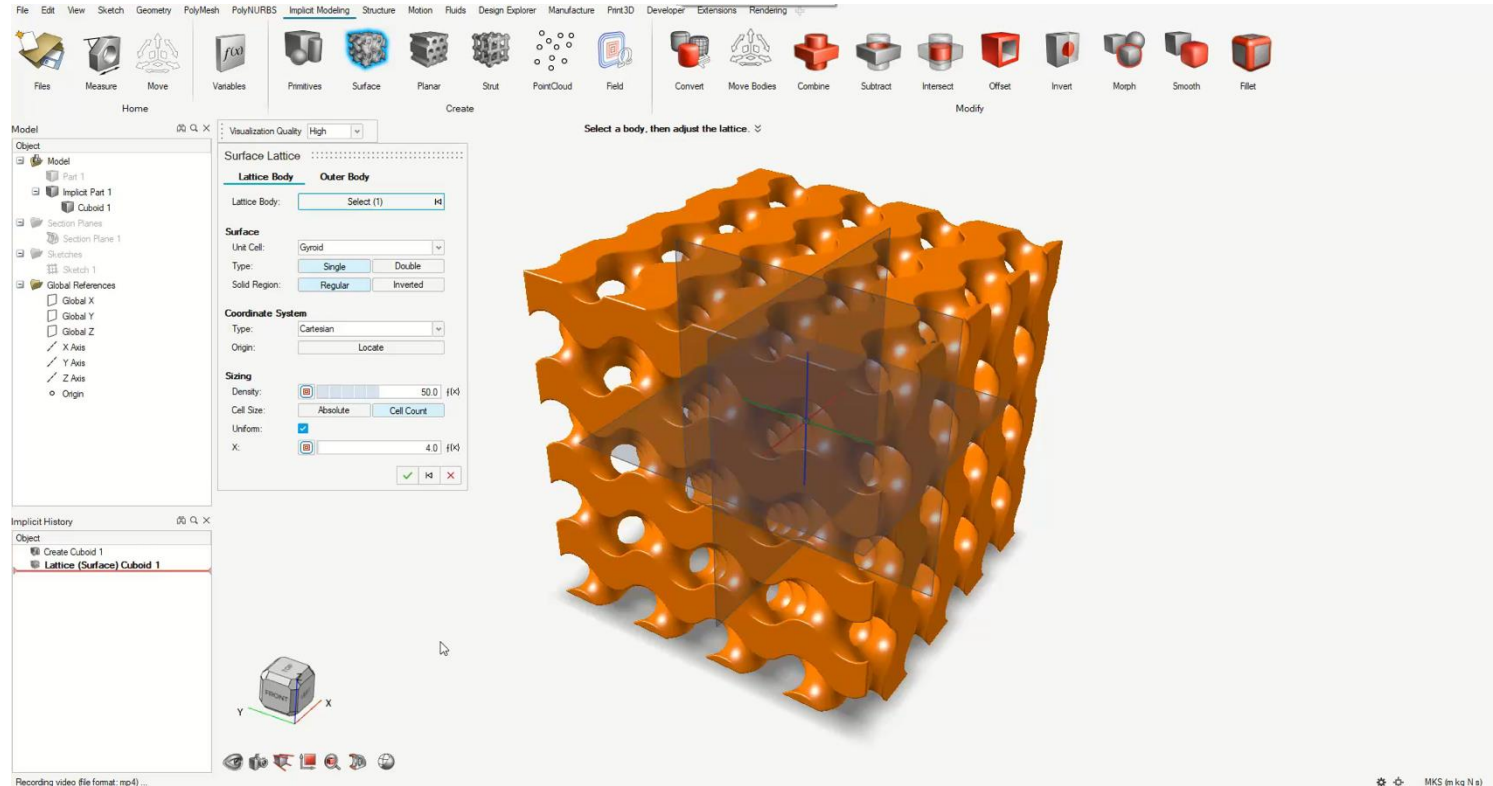
Manual or
Imported Data
Use simulation
data by importing
a CSV file or
define a point
cloud.



Custom Function

Python API
Use your own
equation using
the Python API to
finely control any
parameter.

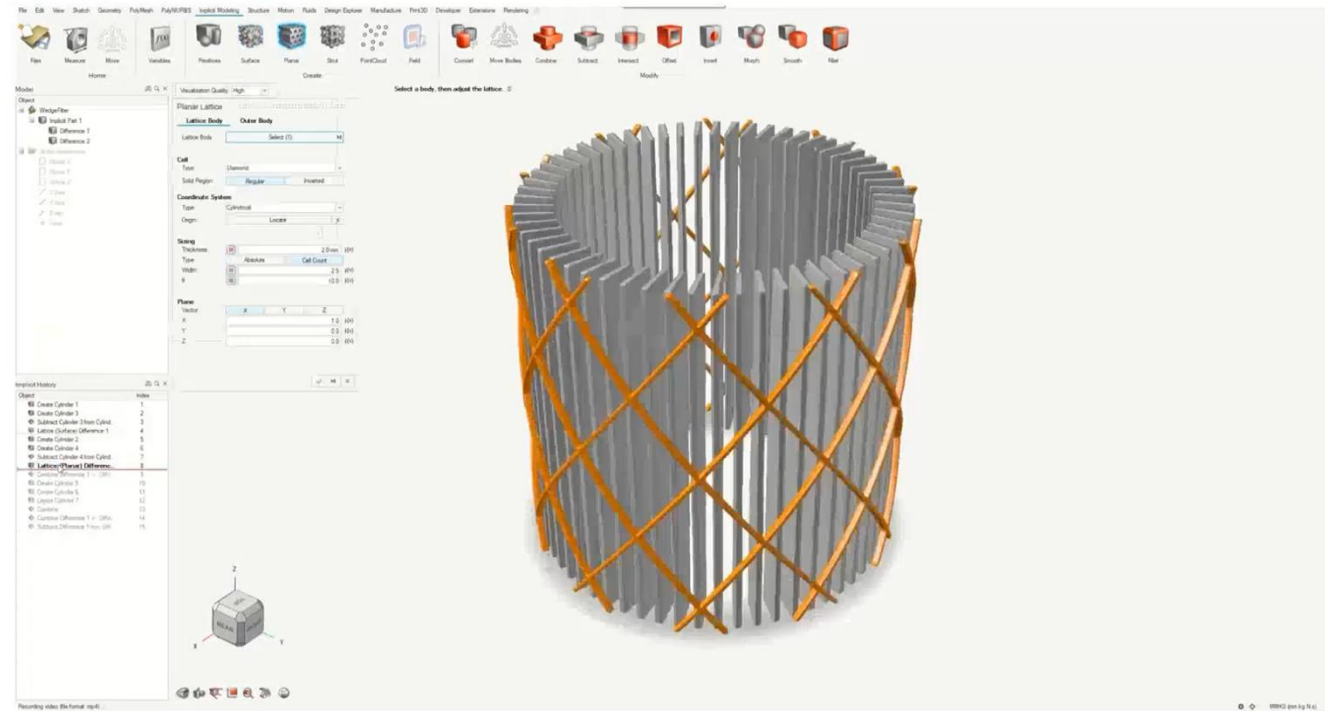
FIELD-DRIVEN DESIGN



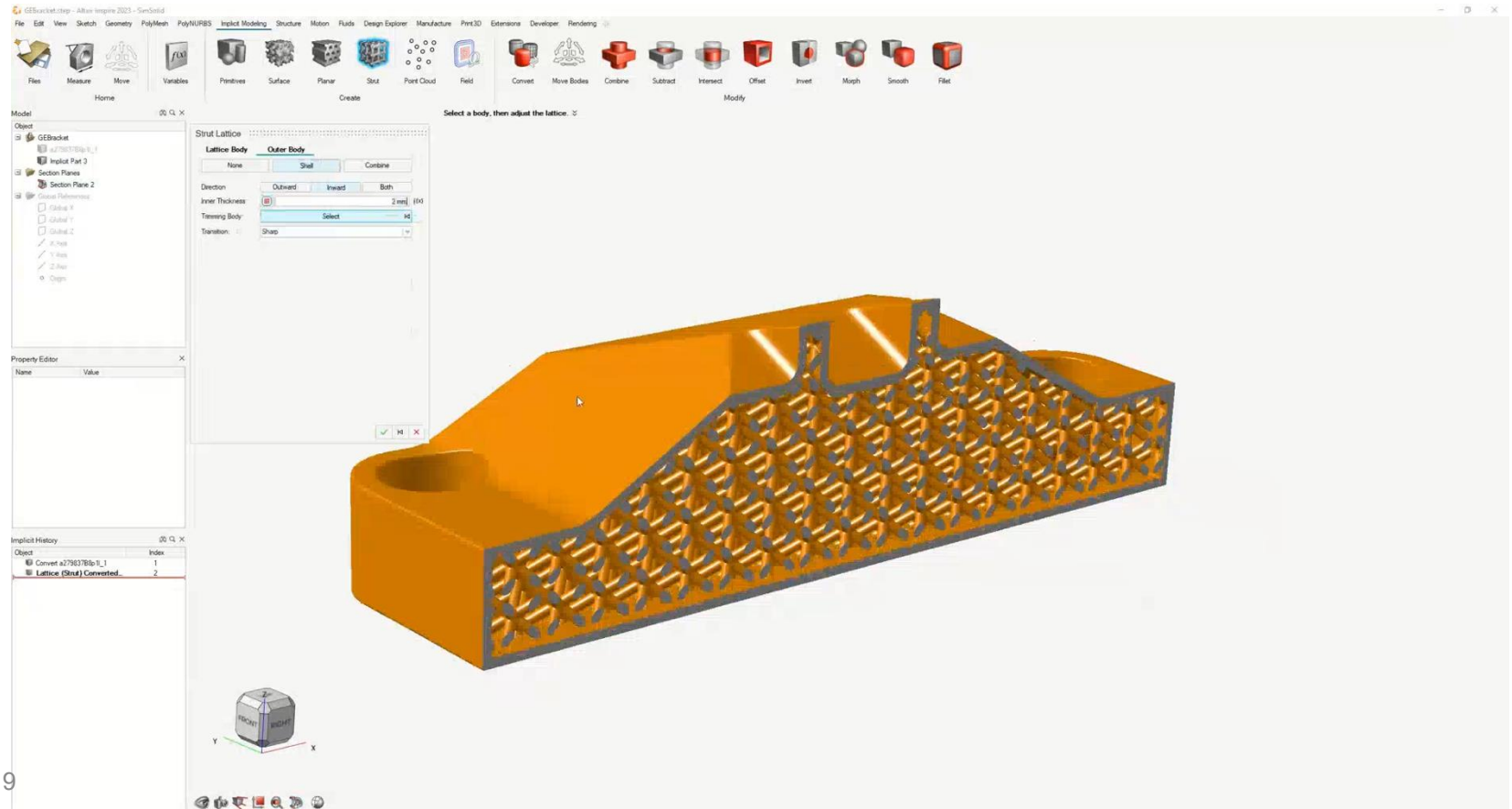
IMPLICIT GEOMETRY

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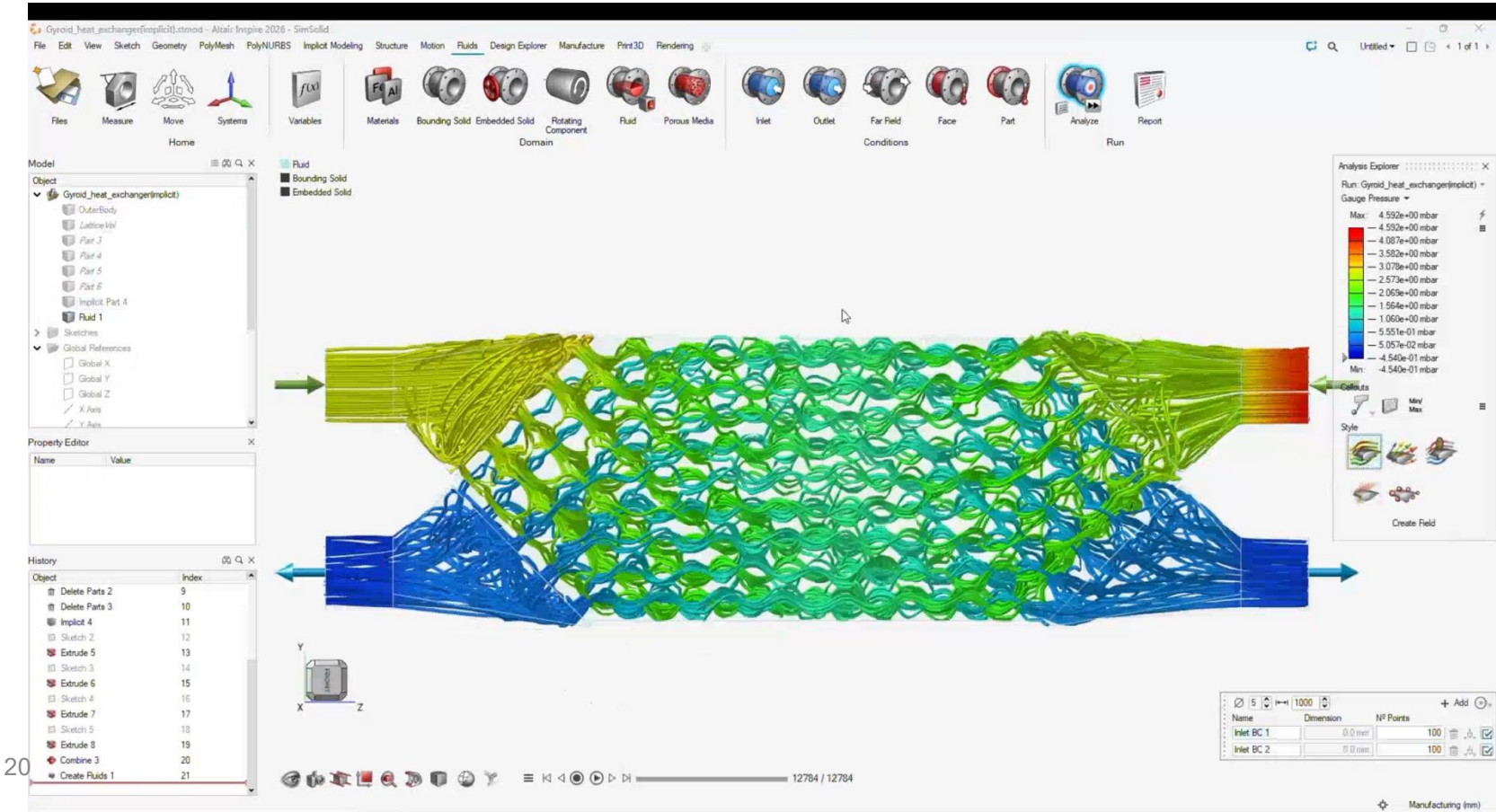
GPU acceleration



IMPLICIT GEOMETRY



IMPLICIT GEOMETRY



THANK YOU

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