

# Ultrasim® 3D Lattice Design Offering

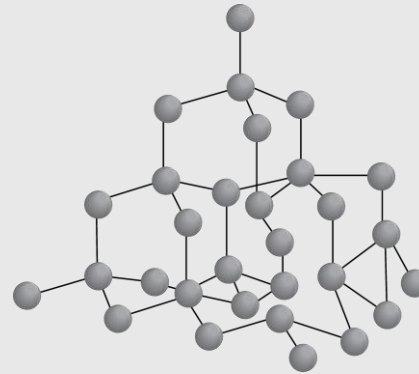


# Where can you find lattices today?

Lattices is nothing new

Bendsøe and Sigmund, 2003:

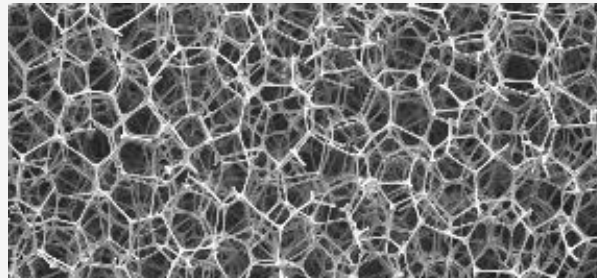
“ Any material is a structure if you look at it through a sufficiently strong microscope. ”



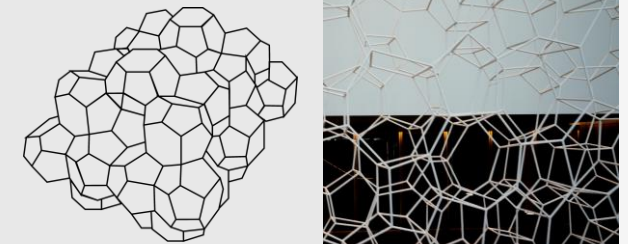
Diamond Structure



Architecture



Basotect® - BASF



Weaire-Phelan Structure

# What are 3D printed Lattices?

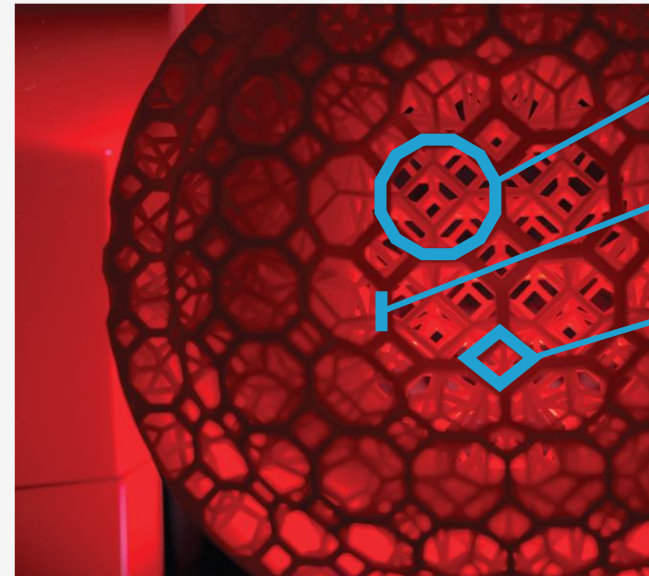
## Lattices Background

- 3D-printed lattices are **repeated patterns** comprised of a network of cells, beams, and nodes.

## Benefits at a Glance

- ✓ Heat transfer & ventilation
- ✓ Aesthetics
- ✓ Lightweight
- ✓ One material, many lattices, many behaviours

## Lattice Characteristics



Lattice Cell

Lattice Beam

Lattice Node

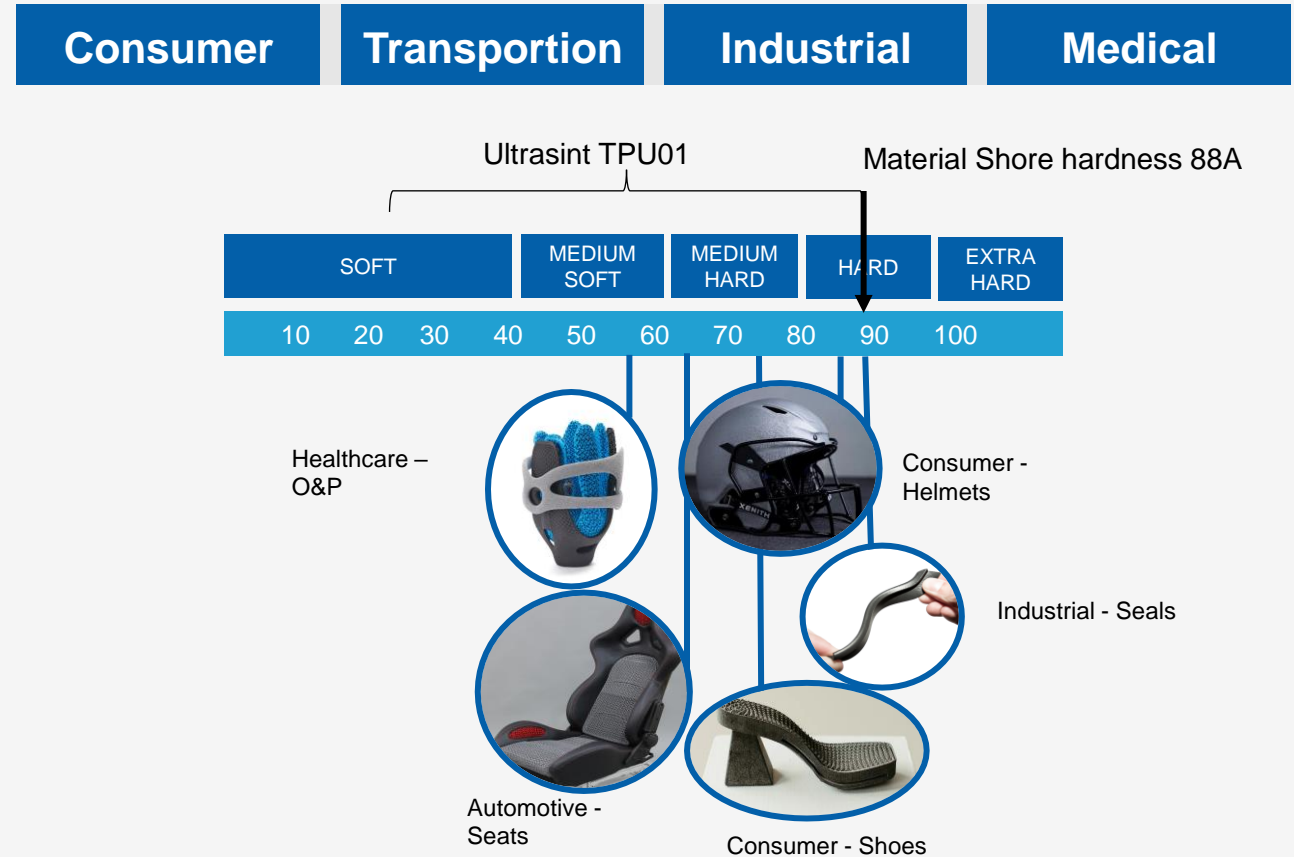


Lattices unlock entirely new designs

# Ultrasint® TPU01

## Value Proposition:

- **High shock absorption, energy return and resistance to fatigue**
- **Use in wide range of industries**
- Good chemical resistance
- Passed skin contact tests
- 80/20 (old/new) Recyclability ratio
- Ultrasim® 3D Lattice Design for application enablement
- Post-processing like coating and vapour smoothing

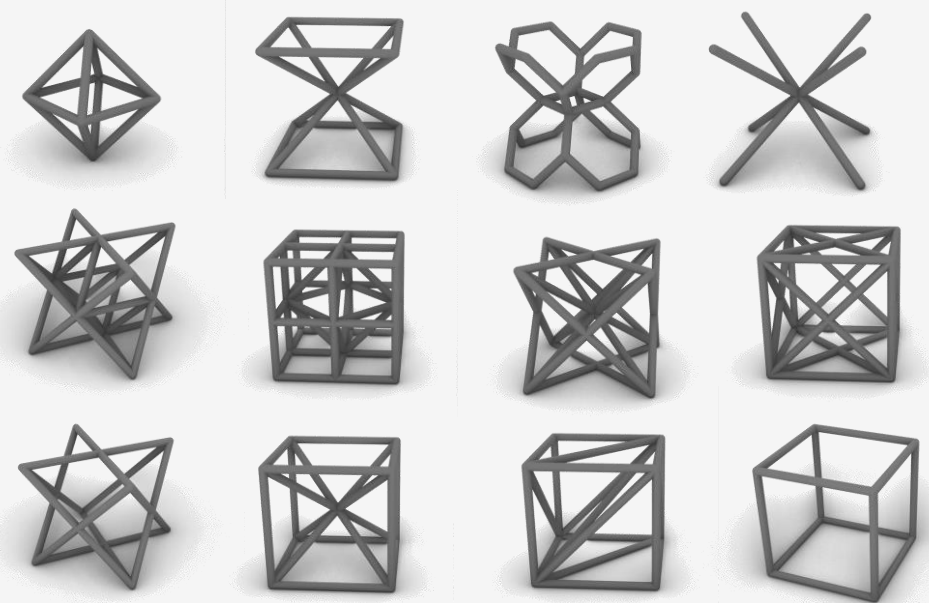
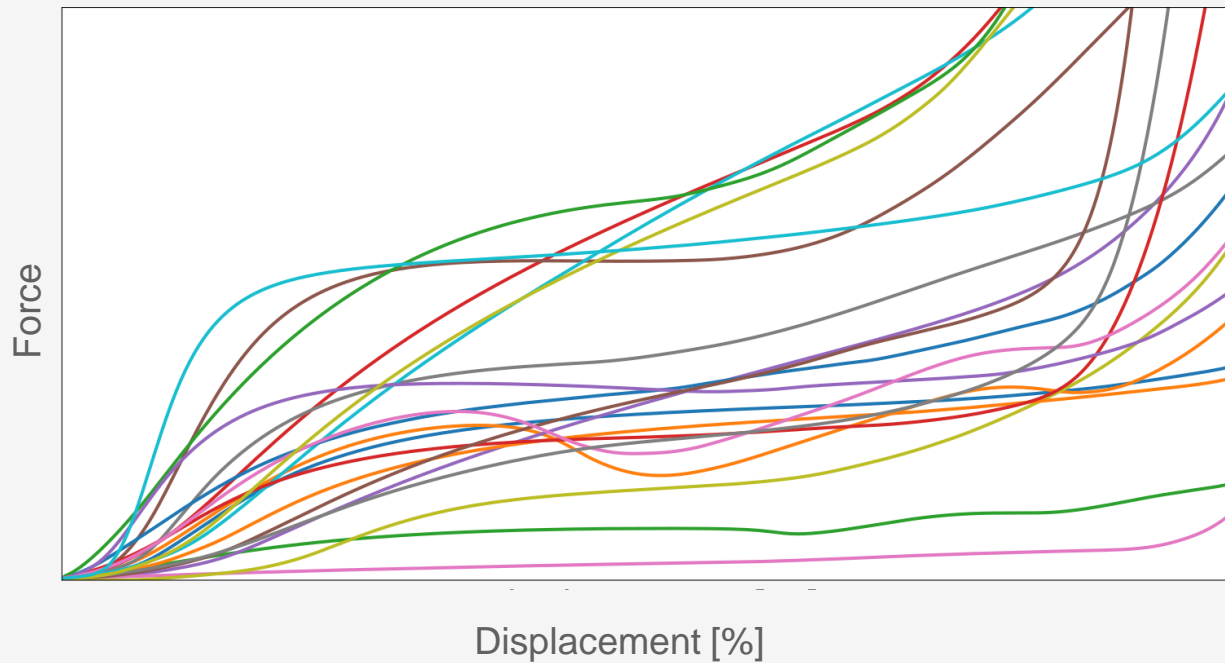


**Ultrasint® TPU01 used as single material in wide range of industries**

# There are millions of different lattices out there

Where to start?

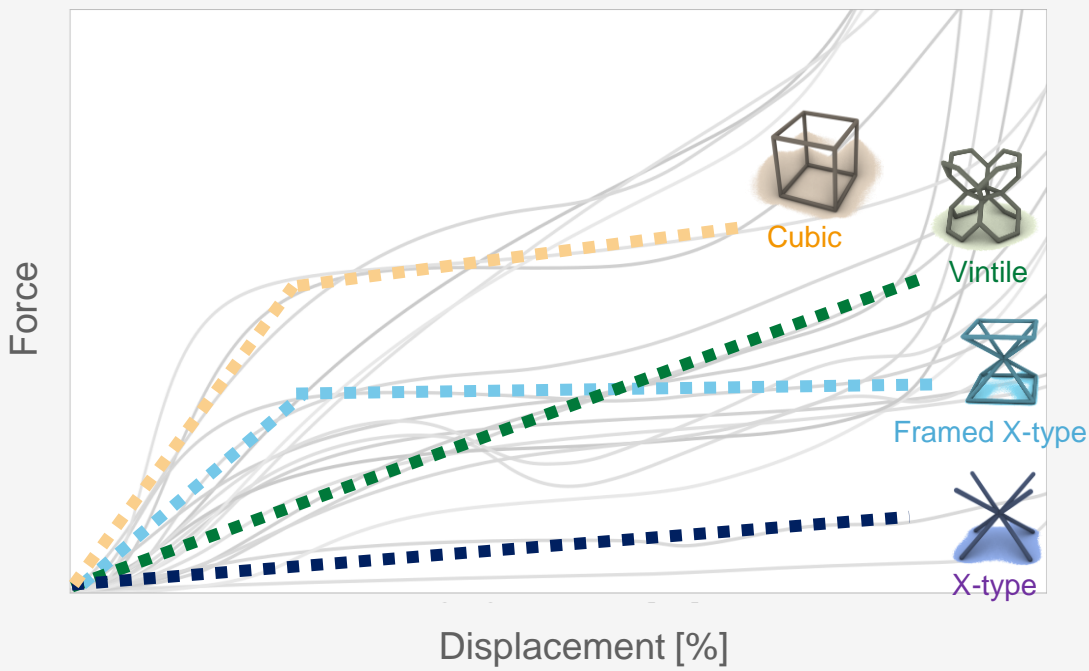
## Force-Displacement-Curve of Ultrasint® TPU01 Lattices:

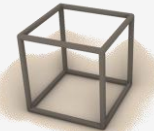

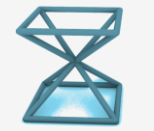

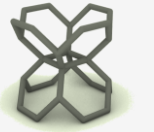





Endless options lead to selection problem

# How to find the right lattice for your application?

One material, many behaviors

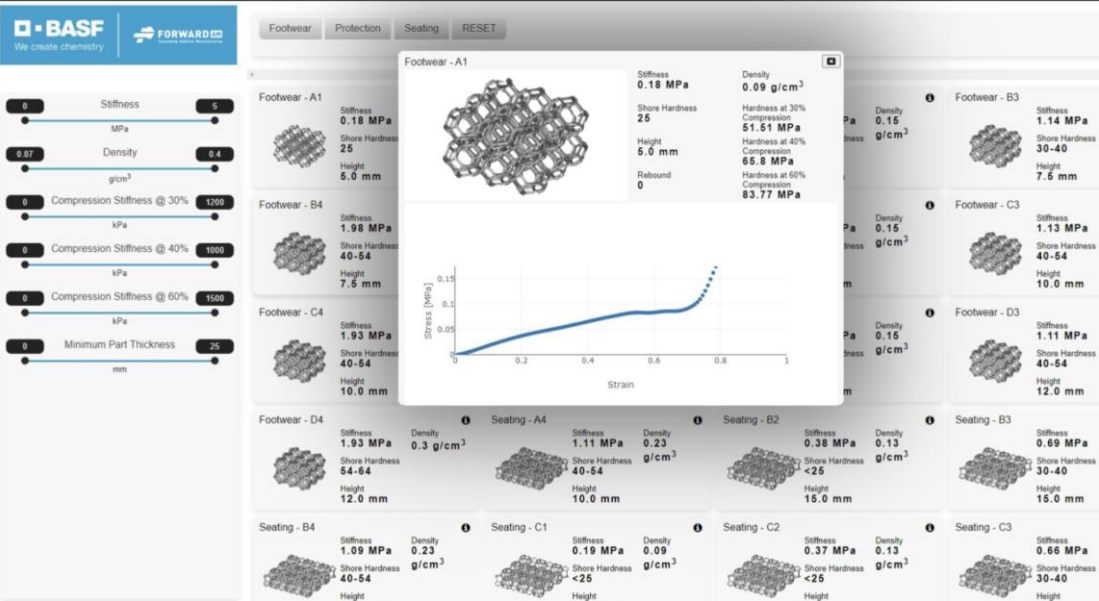


	High energy absorber	
	Low energy absorber	
	High linear stiffness	
	Low linear stiffness	

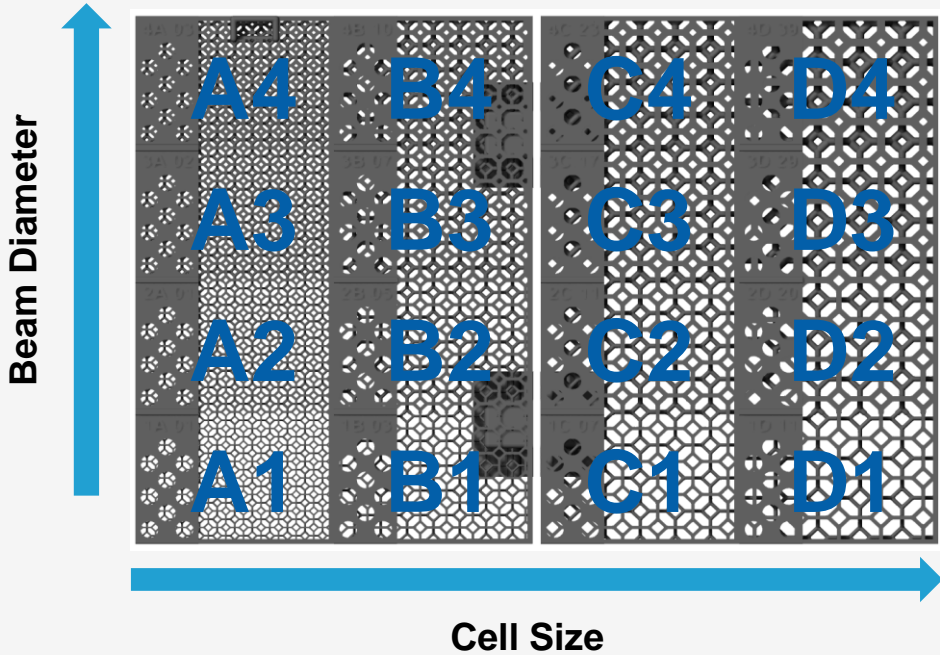
 Match lattice behaviour with application requirements

# How to implement the right lattice in your application?

## 1 Digital Ultrasim® 3D Lattice Library:



## 2 Printed Ultrasim® 3D Lattice Test Pad:



➤ Ultrasim® 3D Lattice Library allows to choose from a large database of lattices

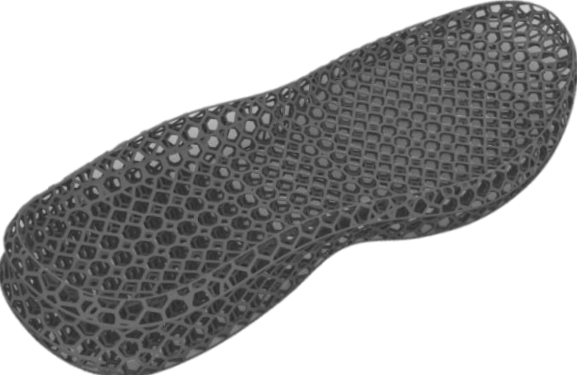
# We support you in every stage – from starter to expert

To obtain the optimum performance the right lattice is key. We offer 3 easy methods to find the right lattice and generate the validated lattice design made from our Ultrasint® TPU01:

## Starter

### Lattice Design Service:

Get one of our lattice engineers to design your customized lattice design incl. partial, multi-zone lattices & more.



## Premium

### Foam Replacement:

Use our in-house developed FEA and lattice library to mimic a foam you use today by a lattice.



## Enterprise

### Full Engineering:

We support you in each step of the product design development for your ideal lattice design.





# Ultrasim® 3D Lattice Design - Offering

	Starter	Premium	Enterprise
	<p><b>Lattice Design Service</b></p> <p>Get one of our lattice engineers to design your customized lattice design incl. partial, multi-zone lattices &amp; more.</p>	<p><b>Foam Replacement</b></p> <p>Use our in-house developed FEA and lattice library to mimic a foam you use today by a lattice.</p>	<p><b>Full Engineering</b></p> <p>We support you in each step of the product design development for your ideal lattice design.</p>
<b>What you get:</b>	✓	✓	✓
• STL-file of digital lattice part	✓	✓	✓
• Digital stress strain curves of lattice	✓	✓	✓
• Customized 3D printed lattice sample		✓	✓
• Digital stress-strain curves of tested foam		✓	✓
• Full engineering support			✓
<b>Add-on:</b>			
• Ultrasim® 3D Lattice Test Pad Footwear, Protection, Seating (99 €/each)	✓	✓	✓
• Partial skin (250 €)	✓	✓	✓
• Multi-zone lattices (250 €)	✓	✓	✓
<b>What we need from you:</b>	<ul style="list-style-type: none"> <li>• STL or any closed mesh<sup>1</sup></li> <li>• Code from our Lattice Test Pad</li> </ul>	<ul style="list-style-type: none"> <li>• STL or any closed mesh<sup>1</sup></li> <li>• Foam sample minimum 50x50x50cm</li> <li>• Stress Strain Curve according to e.g. ISO3386</li> </ul>	<ul style="list-style-type: none"> <li>• 1 hour of your time to understand your problem and derive a solution concept</li> </ul>
<b>Price:</b>	Starting at 490 €	Starting at 2.500 €	On request
<b>Lead time:</b>	On request	On request	On request

<sup>1</sup> Disclaimer: Limited to part size of less than 300x250x250mm; larger parts needs to be segmented which requires a segmentation concept (premium solution)

# How it Works



# Starter - Workflow: Lattice Design Service

- Choose application specific lattices from our lattice catalogue

## 1. Find your application in our Lattice Catalogue

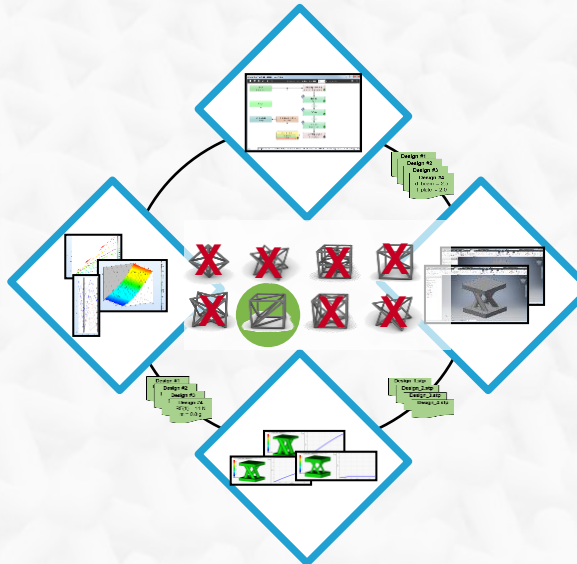
You choose one application resembling your product and provide us your STEP/STL file.



STL or any closed mesh (.stl, .obj)

## 2. We generate the lattice design

We generate a mesh (.stl) to fill the lattice into your part.



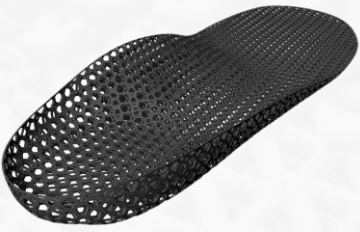
## 3. You receive the digital lattice design

An .stl with the lattice design of your part is sent to you for validation and printing.



# Starter 2 - Workflow: Overview Lattice Catalogue

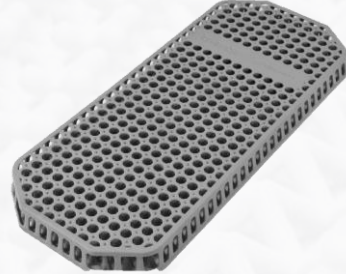
 Insole



 Midsole



 Protective Pad



 Protective Helmet



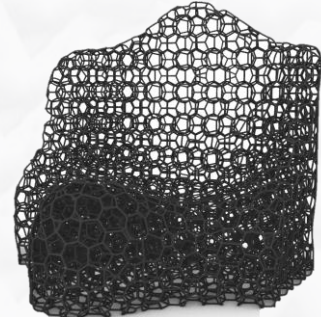
 Head Rest



 Motor Bike Seat



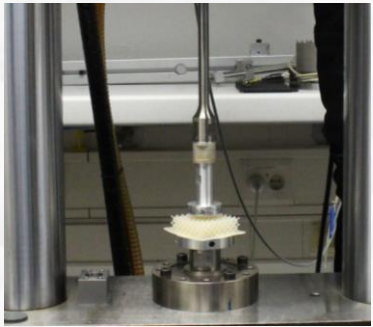
 Seat



# Premium Workflow: From Foam to Lattice

## 1. Physical testing of foam sample

Send us a piece of foam (100x100x50mm). We test the foam sample to characterize its properties.



## 2. Finding the right lattice using FEA

We match the stress-strain behavior of your foam and its behavior with our lattices.



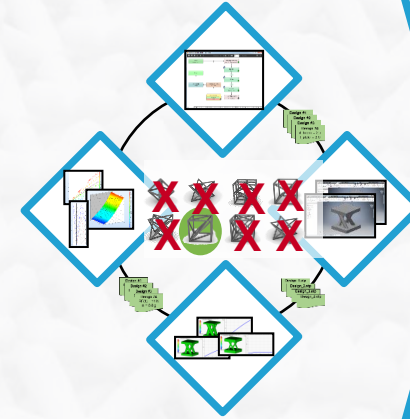
## 3. Receive your specific physical lattice sample

Creation of a lattice pad around the optimum lattice parameters is send to you for a final decision on lattice.



## 4. You receive the digital lattice design

We generate your customized lattice into your part or a generic sample.



## 5. Final Part design

You receive a stl-file with the lattice design of your part.



# Enterprise - Workflow: Full Engineering

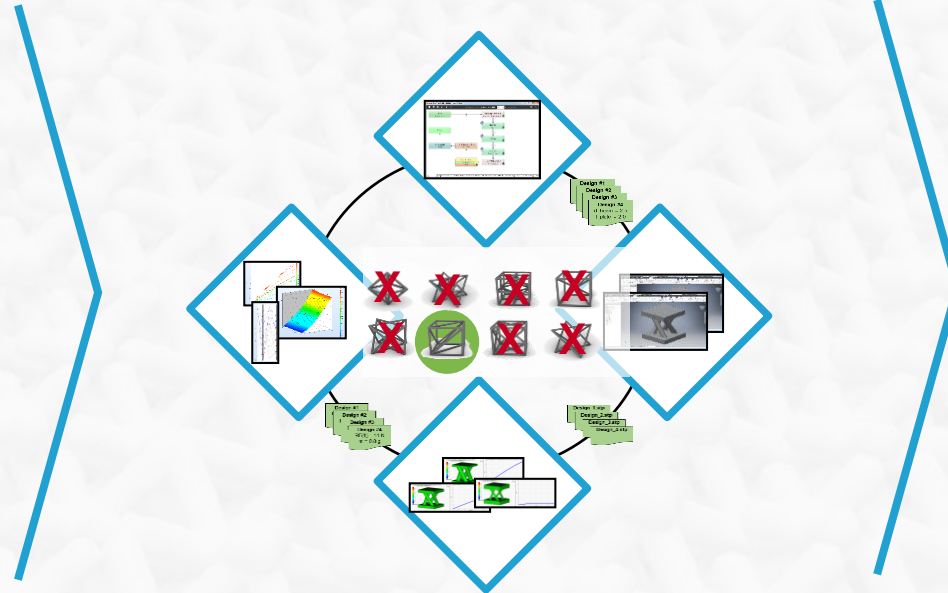
## 1. Kick-Off Meeting

1 hour of your time to understand your problem and derive a solution concept. This may include a lattice development, a full product development or out-of-the-box service.



## 2. We develop the customized solution together

Depending on the customized solution concept, we work together to develop your lattice design.



## 3. You receive the digital lattice design

An .stl with the lattice design of your part is sent to you.



# Any Questions? Contact Us!

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 - **BASF**

We create chemistry



**FORWARD AM**

Innovating Additive Manufacturing