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# ULTRASIM® 3D LATTICE-DESIGN

EXPAND DESIGN POSSIBILITIES USING JUST ONE MATERIAL

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The background of the slide features a 3D printer, specifically an Ultimaker X1E, with its control screen visible in the upper left. A hand is shown holding a black, printed mechanical part in the lower right. The text is overlaid on this background.

## OUR MISSION

OUR MISSION IS TO EMPOWER **EVERYONE TO USE AM IN THEIR MANUFACTURING PROCESSES**, SIMPLY AND SUSTAINABLY.

## OUR VISION

WE BELIEVE IN A FUTURE WHERE **ADDITIVE MANUFACTURING IS A CORE ELEMENT IN EVERY MANUFACTURING PROCESS**.

# FORWARD AM IN SHORT

## WHAT MAKES US UNIQUE

We are the **only** global independent, technology-agnostic provider of materials, services, and solutions in the Additive Manufacturing Industry.

From materials, consultancy and development, through bespoke design, digital simulation and prototype printing, to finishing and exhaustive component testing.

We drive the success of users with AM solutions.

MAKE THE INCREDIBLE





# ULTRASIM® 3D LATTICE DESIGN

Ever imagined a single material could feel as hard as solid plastic and as soft as foam?

Learn how you unlock the full potential of your 3D design with our Ultrasim® 3D Lattice Design Service.

# WHAT ARE LATTICES?

## 3D PRINTED MICRO ARCHITECTURES FOR UNIQUE DESIGNS

3D-printed lattices are structural patterns of interconnected elements that enable unique designs which are impossible to achieve with traditional manufacturing.

By fine-tuning lattice characteristics, a single material can achieve a diverse range of mechanical properties.



Design Freedom



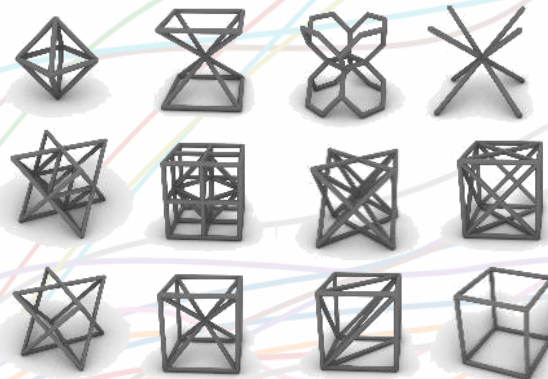
Weight Reduction



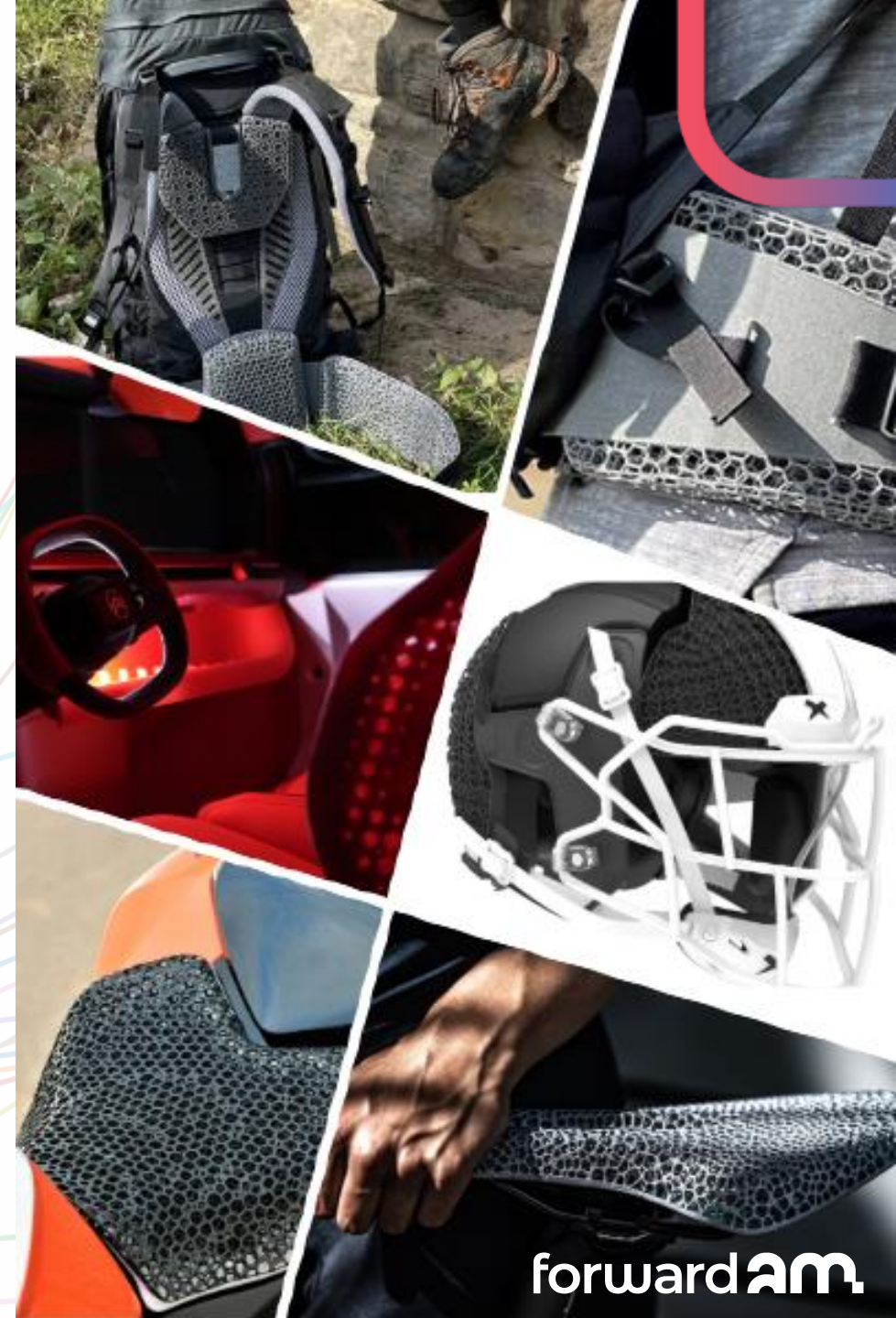
Passive Ventilation



Impact Recovery Systems



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# Skip the “Lattice Road to Hell”

Let us help you

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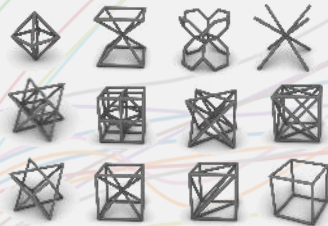


# LEVERAGING 3D PRINTED LATTICES

AVOID COSTLY GUESSWORK, UNLOCK SUPERIOR LATTICE PERFORMANCE

## ENDLESS POSSIBILITIES OF DESIGNS & PROPERTIES

- Finding the ideal lattice structure requires expert designers & engineers
- Challenge of endless trial-and error attempts



Avoid the  
“Lattice Road  
to Hell”



## ULTRASIM® 3D LATTICE DESIGN

- Extensive lattice library with validated, diverse mechanical performances
- Reduces costly trial-and-error for optimal designs from the start
- Full scale solution from ideation to certification



## UNLOCK NEW FUNCTIONS POSSIBILITIES

- ⬡ Aesthetics ⬡ Ventilation
- ⬡ Lightweighting
- ⬡ Pressure Management
- ⬡ One material, multiple lattice designs, multiple behaviors



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







# ULTRASIM® 3D LATTICE LIBRARY

## VALIDATED LATTICES FOR FIRST-TIME-RIGHT LATTICE DESIGN









Having characterized thousands of lattice designs, Forward AM developed a lattice library capturing the mechanical performances of lattices at various cell sizes and thicknesses.

This minimizes costly & resource intensive trial-and-error and ensures desirable lattice designs from the get-go!









### Footwear

<b>Footwear - A1</b>	 Stiffness 0.38 MPa Shore Hardness <27 Height 7.5 mm Density 0.1 g/cm <sup>3</sup> Material TPU01	<b>Footwear - A2</b>	 Stiffness 0.67 MPa Shore Hardness 30-40 Height 7.5 mm Density 0.13 g/cm <sup>3</sup> Material TPU01
<b>Footwear - A3</b>	 Stiffness 1.16 MPa Shore Hardness 30-40 Height 7.5 mm Density 0.17 g/cm <sup>3</sup> Material TPU01	<b>Footwear - A4</b>	 Stiffness 1.8 MPa Shore Hardness 40-54 Height 7.5 mm Density 0.21 g/cm <sup>3</sup> Material TPU01
<b>Footwear - B1</b>	 Stiffness 0.23 MPa Shore Hardness <27 Height 10.0 mm Density 0.08 g/cm <sup>3</sup> Material TPU01	<b>Footwear - B2</b>	 Stiffness 0.67 MPa Shore Hardness <27 Height 10.0 mm Density 0.13 g/cm <sup>3</sup> Material TPU01
<b>Footwear - B3</b>	 Stiffness 1.15 MPa Shore Hardness 30-40 Height 10.0 mm Density 0.17 g/cm <sup>3</sup> Material TPU01	<b>Footwear - B4</b>	 Stiffness 1.83 MPa Shore Hardness 40-54 Height 10.0 mm Density 0.21 g/cm <sup>3</sup> Material TPU01

### Protection

<b>Protection - C3</b>	 Stiffness 8.33 MPa Shore Hardness 64-74 Height 25.0 mm Density 0.39 g/cm <sup>3</sup> Material TPU01	<b>Protection - A3</b>	 Stiffness 2 MPa Shore Hardness 30-40 Height 10.0 mm Density 0.18 g/cm <sup>3</sup> Material TPU01
<b>Protection - A4</b>	 Stiffness 2.7 MPa Shore Hardness 30-40 Height 10.0 mm Density 0.21 g/cm <sup>3</sup> Material TPU01	<b>Protection - B1</b>	 Stiffness 0.95 MPa Shore Hardness <27 Height 12.5 mm Density 0.13 g/cm <sup>3</sup> Material TPU01
<b>Protection - B2</b>	 Stiffness 1.47 MPa Shore Hardness 30-40 Height 12.5 mm Density 0.15 g/cm <sup>3</sup> Material TPU01	<b>Protection - B3</b>	 Stiffness 1.77 MPa Shore Hardness 30-40 Height 12.5 mm Density 0.17 g/cm <sup>3</sup> Material TPU01
<b>Protection - B4</b>	 Stiffness 2.3 MPa Shore Hardness 40-54 Height 12.5 mm Density 0.2 g/cm <sup>3</sup> Material TPU01	<b>Protection - D2</b>	 Stiffness 2.82 MPa Shore Hardness 40-54 Height 12.5 mm Density 0.29 g/cm <sup>3</sup> Material TPU01

### Seating

<b>Seating - A1</b>	 Stiffness 0.3 MPa Shore Hardness <27 Height 15.0 mm Density 0.08 g/cm <sup>3</sup> Material TPU01	<b>Seating - A2</b>	 Stiffness 0.38 MPa Shore Hardness <27 Height 15.0 mm Density 0.12 g/cm <sup>3</sup> Material TPU01
<b>Seating - A3</b>	 Stiffness 0.69 MPa Shore Hardness 30-40 Height 15.0 mm Density 0.16 g/cm <sup>3</sup> Material TPU01	<b>Seating - A4</b>	 Stiffness 1.09 MPa Shore Hardness 40-54 Height 15.0 mm Density 0.21 g/cm <sup>3</sup> Material TPU01
<b>Seating - B1</b>	 Stiffness 0.19 MPa Shore Hardness <27 Height 20.0 mm Density 0.08 g/cm <sup>3</sup> Material TPU01	<b>Seating - B2</b>	 Stiffness 0.36 MPa Shore Hardness <25 Height 20.0 mm Density 0.12 g/cm <sup>3</sup> Material TPU01
<b>Seating - B3</b>	 Stiffness 0.66 MPa Shore Hardness 30-40 Height 20.0 mm Density 0.16 g/cm <sup>3</sup> Material TPU01	<b>Seating - B4</b>	 Stiffness 1.07 MPa Shore Hardness 40-54 Height 20.0 mm Density 0.21 g/cm <sup>3</sup> Material TPU01

### Digital Lattice Library



### Physical Test Pads for 3 use cases



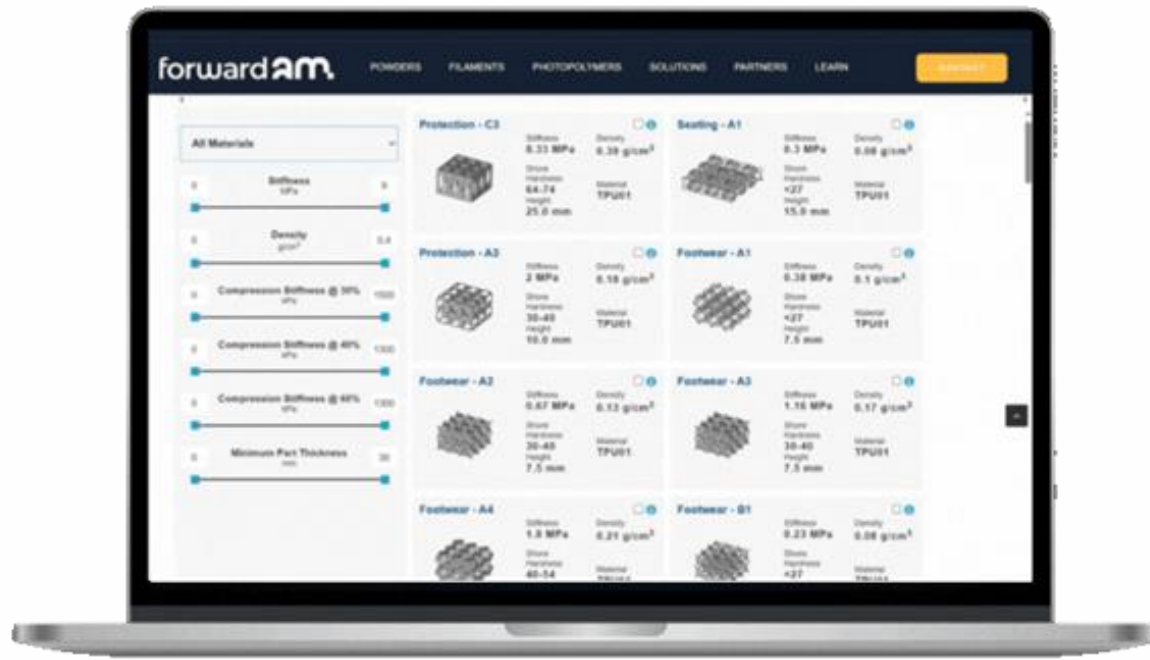
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# ULTRASIM® 3D LATTICE LIBRARY

VALIDATED LATTICES FOR FIRST-TIME-RIGHT LATTICE DESIGN

## ULTRASIM® 3D LATTICE LIBRARY



## ULTRASIM® 3D LATTICE TEST PADS



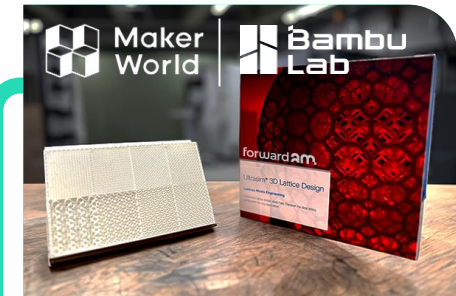
Materials: Ultrasint® TPU01



Materials: Ultrasint® TPU01



Materials: Ultrasint® TPU88A



Materials: Ultrafuse® TPU85A

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# XENTI CASE STUDY DEEP DIVE

REDEFINING HELMET DESIGN  
FOR BETTER SAFETY & COMFORT

[WATCH VIDEO](#)

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# XENITH ORBIT PRO NFL FOOTBALL HELMET

AMBITIOUS INNOVATION WITH ULTRASIM® 3D LATTICE DESIGN & ULTRASINT® TPU01



## NFL TESTING PERFORMANCE RESULTS

- #1 → OFFENSIVE LINEMAN HELMET
- #1 → DEFENSIVE LINEMAN HELMET
- #2 → QUARTERBACKS
- #2 → ALL-POSITIONS



*“This helmet is a perfect example of innovation meeting expertise. Without Forward AM's advanced materials and lattice design capabilities, creating something this lightweight, strong, and precise simply wouldn't have been possible. They're the backbone of turning ambitious concepts into reality.”*

**Kyle Lamson – Director of Product Development at Xenith**

# XENITH ORBIT PRO NFL FOOTBALL HELMET

## REDEFINING HELMET DESIGN FOR BETTER SAFETY AND COMFORT

With Xenith, we used our lattice design expertise and advanced materials to create lightweight, high-performance helmets.

Key Benefits of our Solution:

- Superior Safety & Comfort
- On-Demand Production
- Local Production



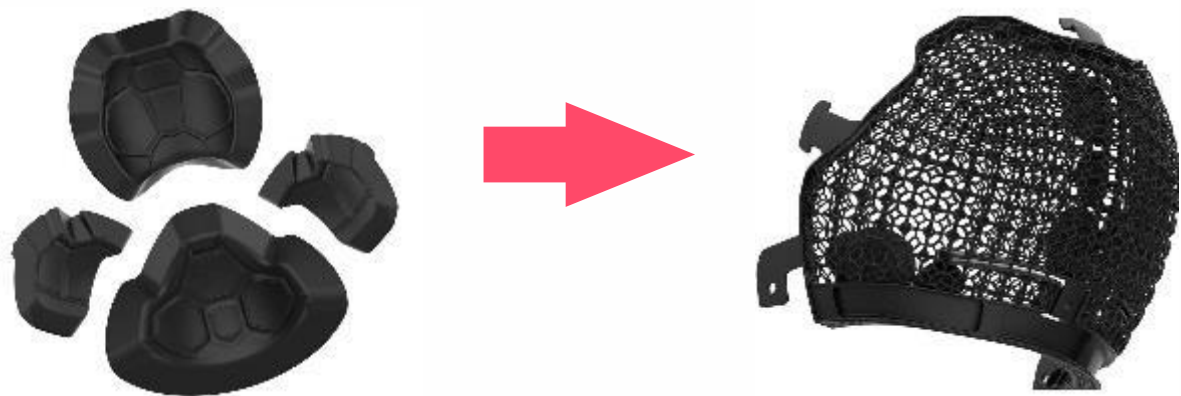
TRADITIONAL SOLUTION:

Conventional Materials:

- Uniform structures limited safety and comfort optimization
- Heavier helmets reduced performance and user experience

Design Constraints:

- Traditional methods restricted design innovation and material efficiency
- Increased material waste during production



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# XENITH ORBIT PRO NFL FOOTBALL HELMET

ULTRASINT® TPU01: THE GO-TO MATERIAL FOR PIONEERING DESIGNS

## KEY BENEFITS OF TPU01

- Balanced Properties: Offers good flexibility and shock absorption
- High Detail Printing: Capable of producing very fine structures with a high level of detail
- Easy to Print: User-friendly printing process
- Durable: Good resistance to UV light and hydrolysis
- Safety Tested: Passed skin sensitization and cytotoxicity tests (ISO 10993-10 and ISO 10993-5)
- Printing Technology: Designed for use in HP Multi Jet Fusion printers



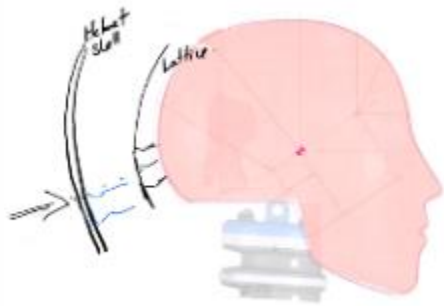
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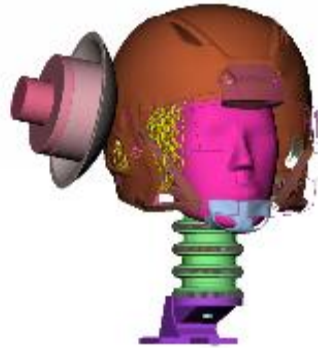
# XENITH ORBIT PRO NFL FOOTBALL HELMET

## SOLUTION APPROACH WITH ULTRASIM® 3D

OUR SOLUTION IN 4 STEPS:



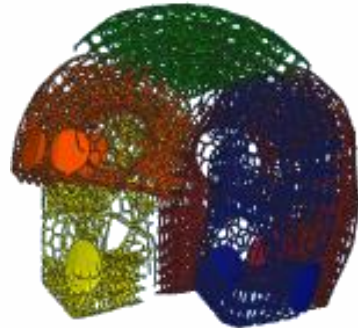
1. IDEATION



2. SIMULATION



3. LATTICE DESIGN



4. TCO & CERTIFICATION

NEW SOLUTION:

Innovative Lattice Structures:

- Optimized for impact absorption and weight reduction
- Precisely engineered zones enhance safety and comfort

Advanced Materials:

- High-performance materials ensure durability and flexibility
- Lightweight design improves long-term wearability



### NFL TESTING PERFORMANCE RESULTS

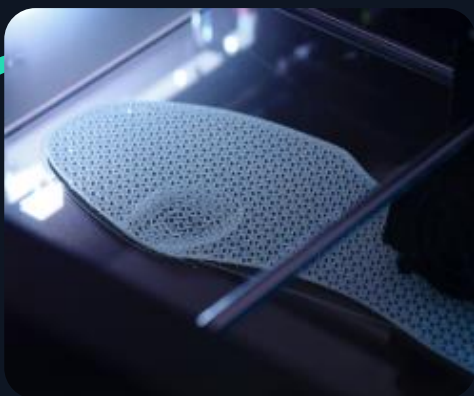
- #1 → OFFENSIVE LINEMAN HELMET
- #1 → DEFENSIVE LINEMAN HELMET
- #2 → QUARTERBACKS
- #2 → ALL-POSITIONS

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# SUCCESS STORIES WITH PODOMESH

WITH OUR ULTRASIM® 3D SERVICES AND SOLUTIONS



*“Podomesh exemplifies our dedication to innovation and enhancing patient outcomes. Our partnership with Forward AM has been pivotal, enabling us to transition from FDM to MJF printing and deliver custom-fit, high-performance footwear.”*

*This collaboration highlights not only our comprehensive end-to-end solution but also the superior quality and support that Forward AM provides, helping us consistently exceed client expectations.”*

**Stijn Paridaens – CEO @Zigzag & Podomesh**

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# SUCCESS STORIES WITH PHILIPP PLEIN

ULTRASINT® TPU88 A FOR INTRICATE LATTICE DESIGNS



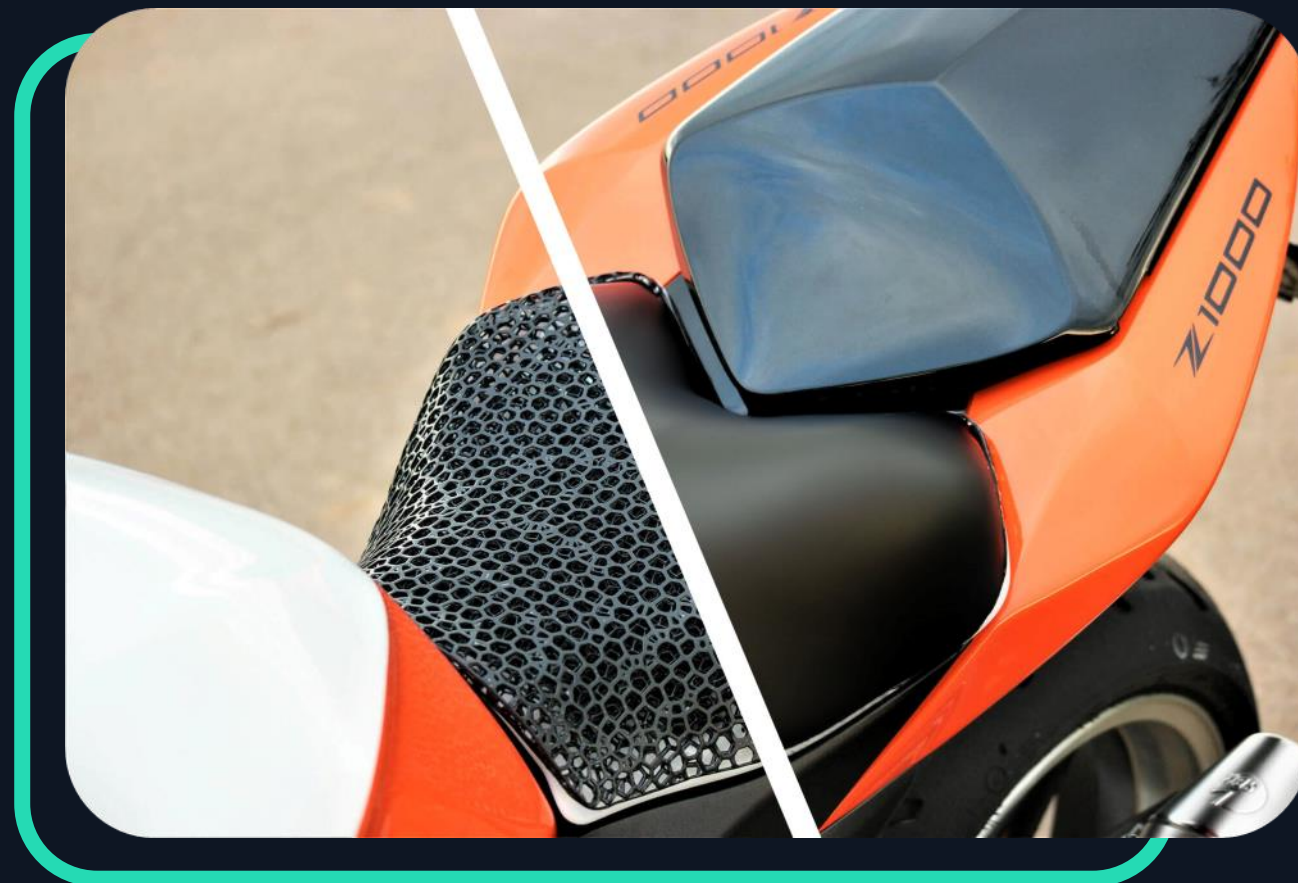
*“Forward AM has opened new doors for us, offering unique flexibility and durability. We’ve utilized their solutions in various applications, from fashion to sports equipment.*

*For Philipp Plein, we produced 2000 unique pieces, using TPU 88A. This allowed us to create intricate lattice designs tailored to the brand’s innovative aesthetic. The project showcased our capability to deliver high-quality, custom pieces on a large scale.”*

**Vanna Menco – CEO @Prosilas**

# LATTICES FOR YOUR APPLICATION

WITH ULTRASIM® 3D LATTICE DESIGN



# ULTRASIM® 3D LATTICE DESIGN

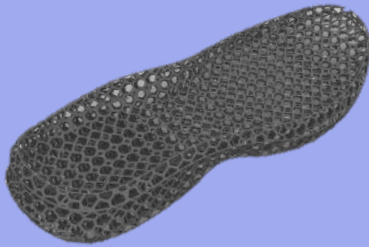
WE SUPPORT YOU IN EVERY STAGE – FROM STARTER TO EXPERT

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 started with your customized lattice design quickly and effortlessly.



## Premium

### Foam Replacement

Mimic your foam using a 3D printed lattice based on our in-house developed FEA and lattice library.



## Enterprise

### Custom Solutions

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



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# ULTRASIM® 3D LATTICE DESIGN - OFFERING

## What you get:

- STL-file of digital lattice part
- Digital stress strain curves of lattice
- Digital stress-strain curves of tested foam
- Customized 3D printed lattice sample
- Full engineering support

## Add-on:

- Ultrasim® 3D Lattice Test Pad (99 €/each)
- Partial skin, multi-zone lattices (250 €/each)
- 3D print your part (price tbd)

## What 3D printing materials:

- Ultrasint®
- Ultrafuse®

## What we need from you:

Lead time:

Price:

## Starter

### Lattice Design Service

✓

✓

✓

✓

✓

TPU01, TPU 88A

TPU 85A

- STL of your part design<sup>1</sup>
- Code from our Ultrasim® 3D Lattice Test Pad

2 weeks

Starting at 490 €

## Premium

### Foam Replacement

✓

✓

✓

✓

✓

✓

✓

TPU01, TPU 88A

TPU 85A

- STL of your part design<sup>1</sup>
- Foam sample min. 50x50x50 mm
- Stress strain curve according to e.g. ISO 3386

4 – 6 weeks

Starting at 2.500 €

## Enterprise

### Custom Solutions

✓

✓

✓

✓

✓

✓

✓

✓

TPU01, TPU 88A

TPU 85A

- 1 hour of your time to understand your problem and derive a solution concept

On request

On request

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<sup>1</sup> Disclaimer: Limited to part size of less than 300 x 250 x 250mm; larger parts needs to be segmented which requires a segmentation concept (premium solution)

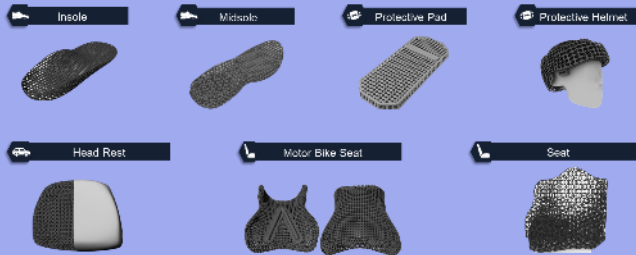
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# STARTER WORKFLOW: LATTICE DESIGN SERVICE

CHOOSE APPLICATION SPECIFIC LATTICES FROM OUR LATTICE CATALOGUE

## 1. Find your application in our Lattice Catalogue

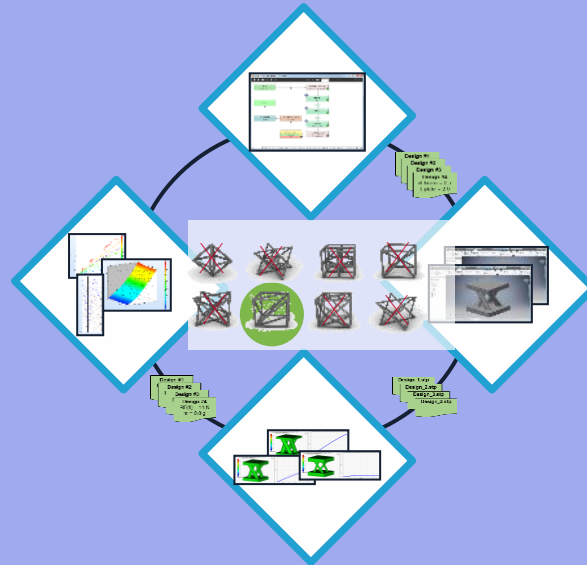
You choose one application resembling your product and provide us your STEP/STL file.



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

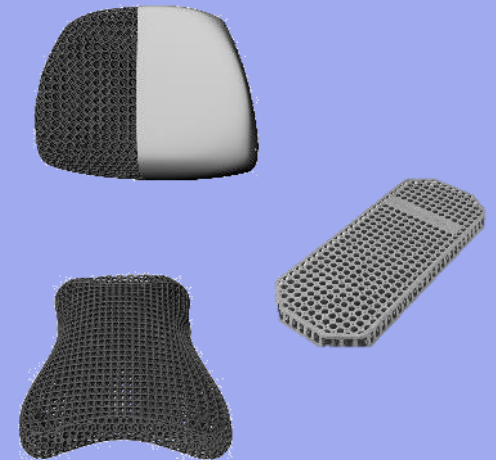
## 2. We generate the lattice design

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.



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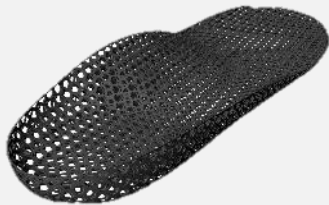
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# STARTER WORKFLOW: OVERVIEW LATTICE CATALOGUE

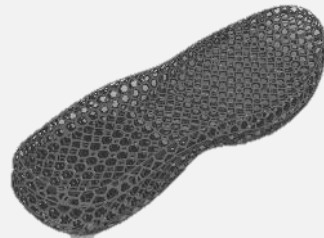
FIND YOUR APPLICATION IN OUR LATTICE CATALOGUE



Insole



Midsole



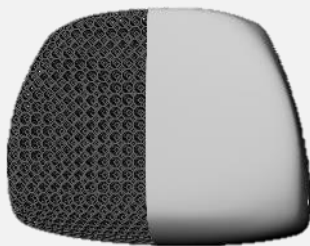
Protective Pad



Protective  
Helmet



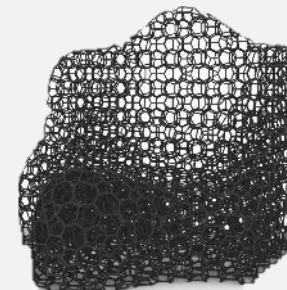
Head Rest



Motor Bike Seat



Seat



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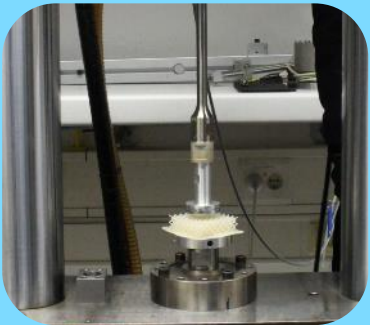
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# PREMIUM WORKFLOW: FROM FOAM TO LATTICE

## OPTIMAL LATTICE PARAMETERS FOR FOAM TO LATTICE REPLACEMENT

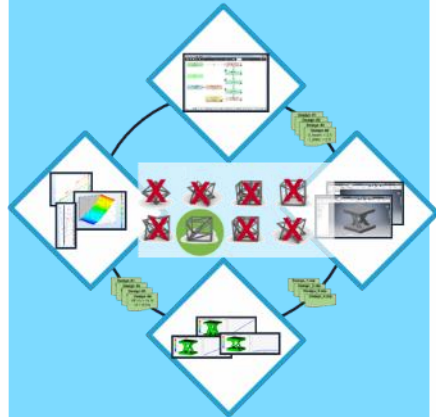
### 1. Physical testing of foam sample

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



### 2. Finding the right lattice using FEA

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



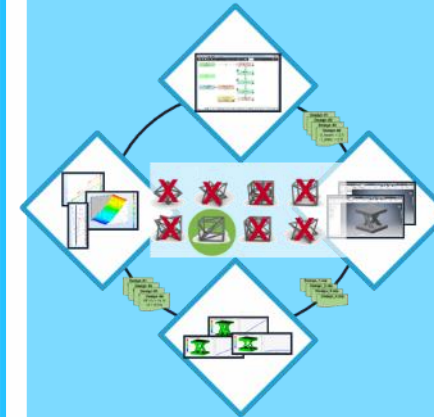
### 3. Receive your specific physical lattice sample

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



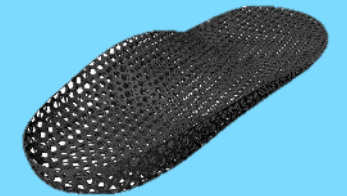
### 4. You receive the digital lattice design

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

## RECEIVE FULL SUPPORT IN DEVELOPING CUSTOMIZED LATTICE SOLUTIONS

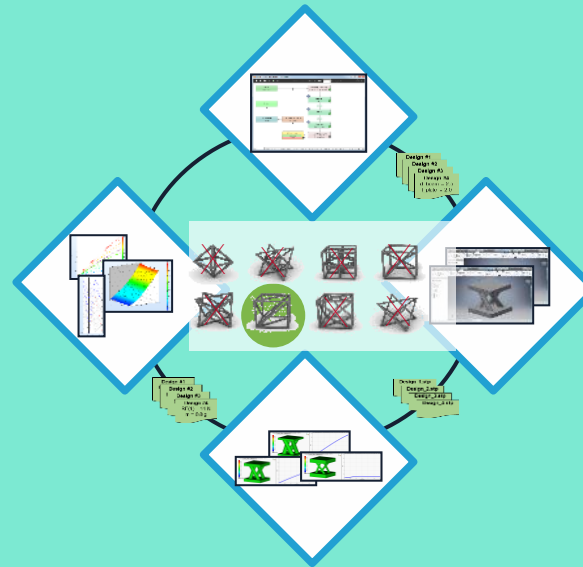
### 1. Kick-Off Meeting

One 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.



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# THANK YOU!

## GET IN TOUCH WITH US



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[sales@forward-am.com](mailto:sales@forward-am.com)



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Business Development Manager

+49 6221 67 41 751

[marius.haefele@forward-am.com](mailto:marius.haefele@forward-am.com)

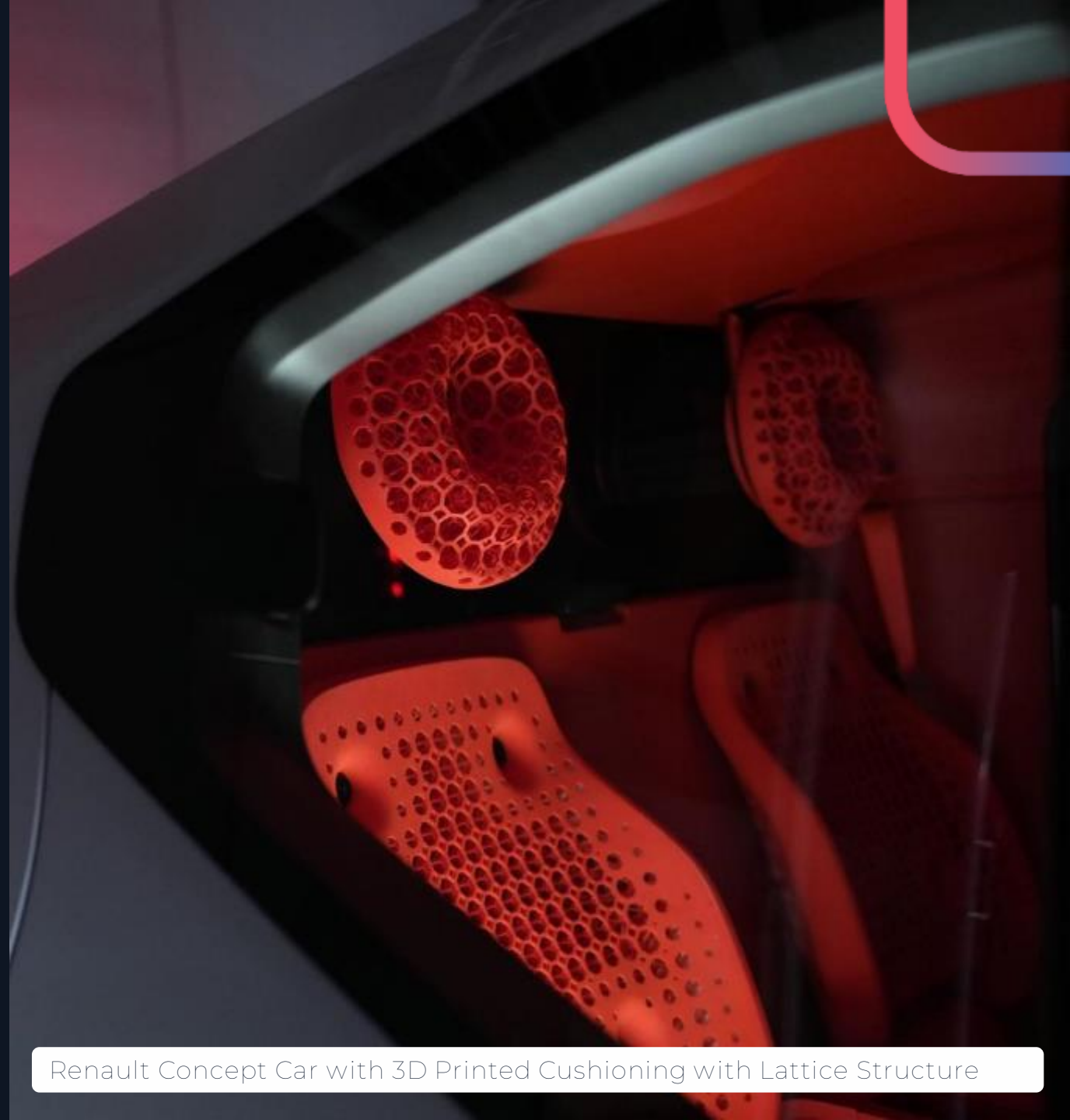
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# Additive and the Future of Manufacturing

The Revolution Redefining  
Product Design and Distributed  
Manufacturing

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Renault Concept Car with 3D Printed Cushioning with Lattice Structure