Impact of Design for Additive Manufacturing (DfAM)

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Intro: What determines performance?

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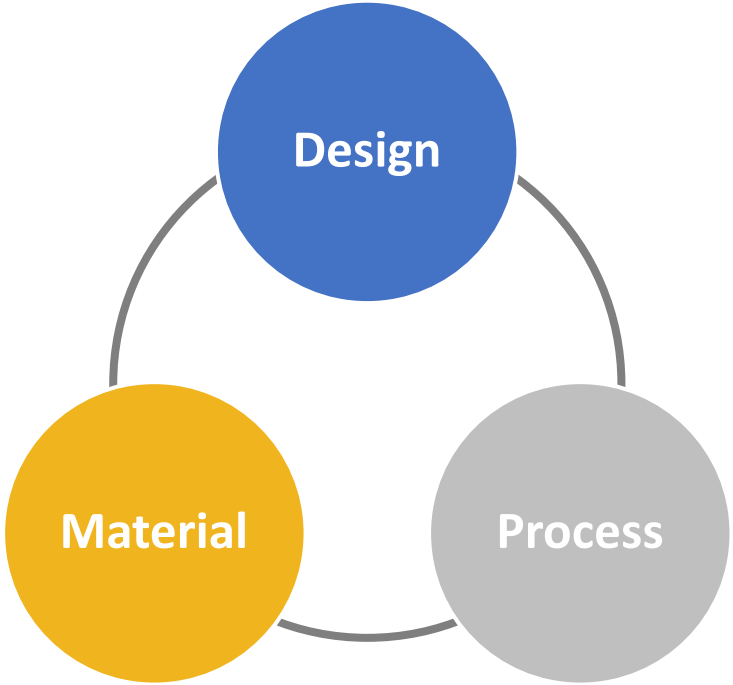

Intro: What determines performance?

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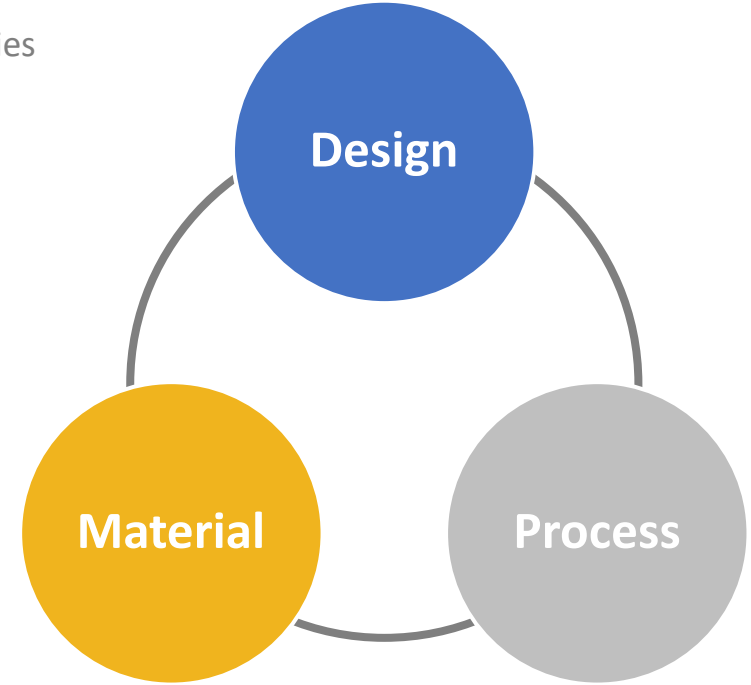
Traditional technologies



Intro: What determines performance?

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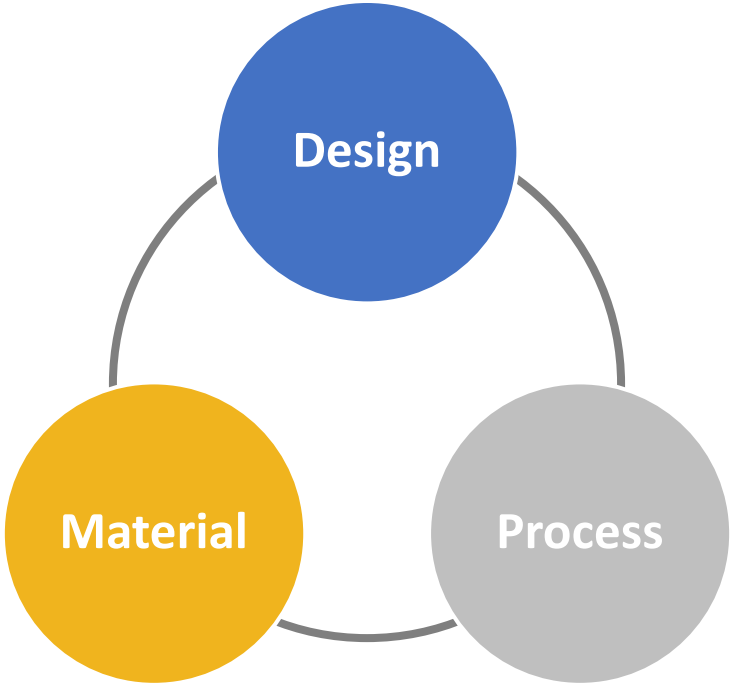

AM technologies

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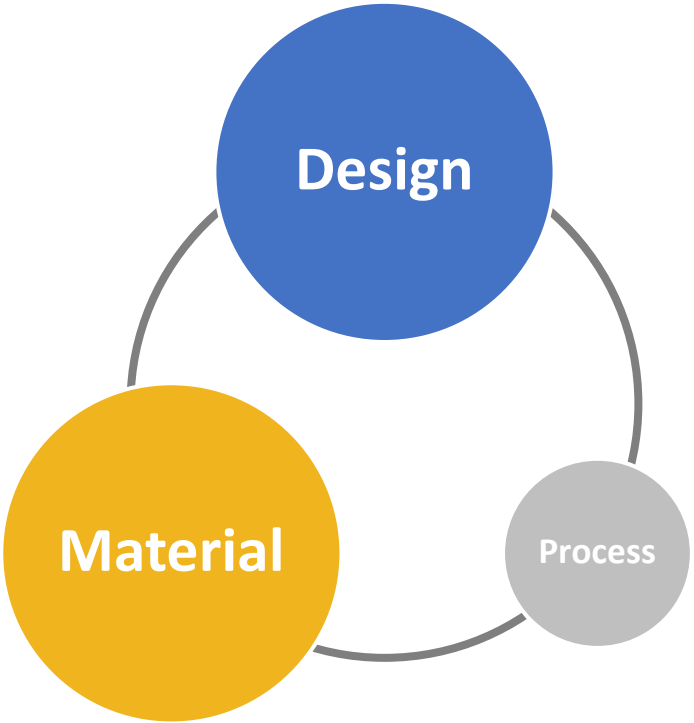
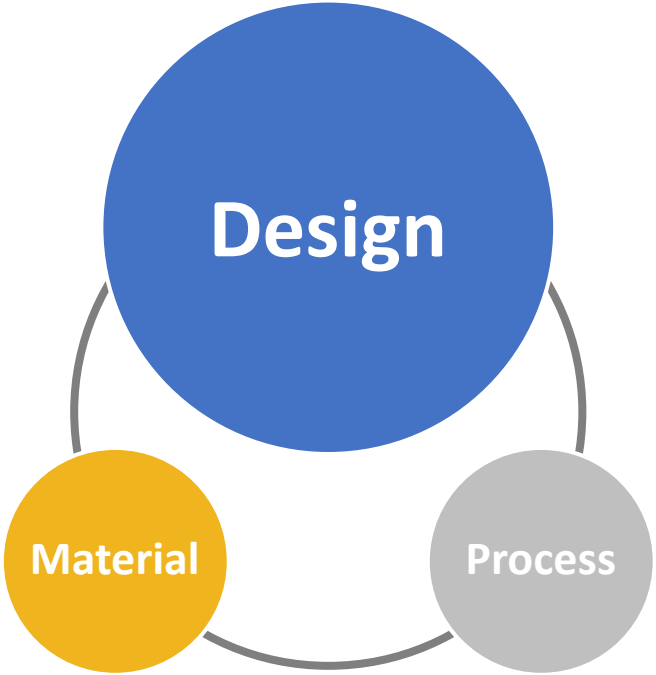


Traditional technologies



AM technologies

What determines performance?

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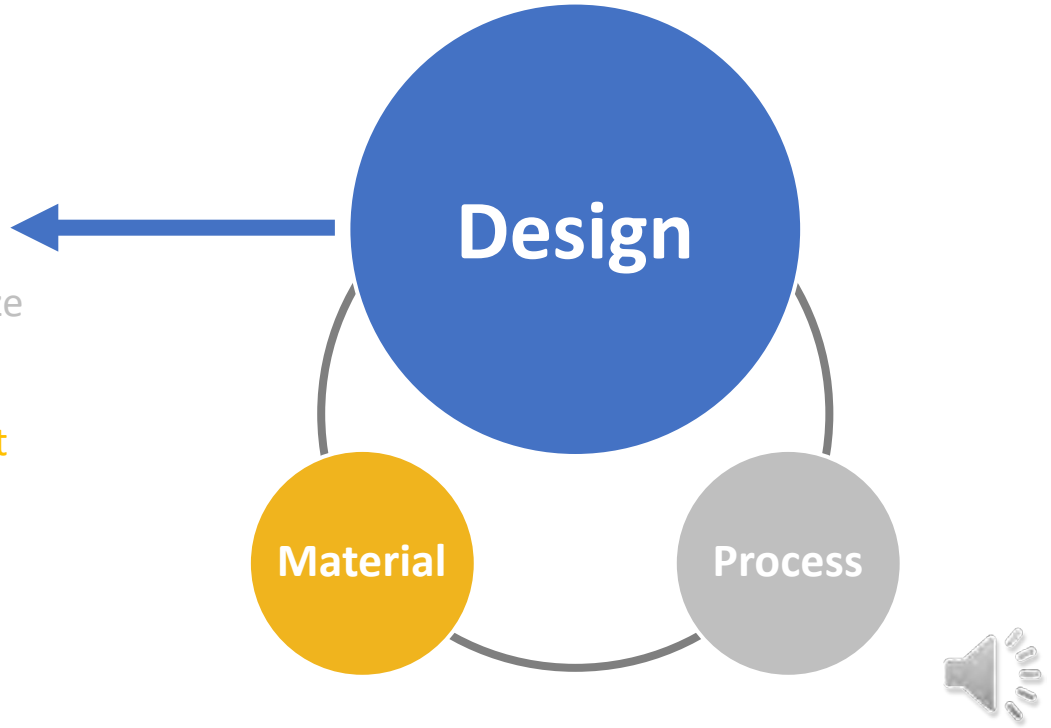
What is the impact of design?

1. Design for printability and optimize production
2. Design for improvements and part performance



Impact of Design

Design for printability and optimize for production

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Optimize for Production

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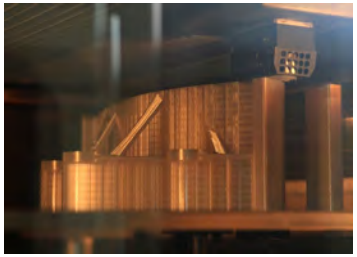
LS Laser Sintering	SLA Stereo Lithography Apparatus	MJF Multi Jet Fusion	FDM Fused Deposition Modeling	SLM Selective Laser Melting
PA, PA-GF, PA-Alu filled, TPU			ABS, PC/ABS, PC, Ultem	
				

Optimize for Production

LS
Laser Sintering

PA, PA-GF, PA-Alu filled, TPU

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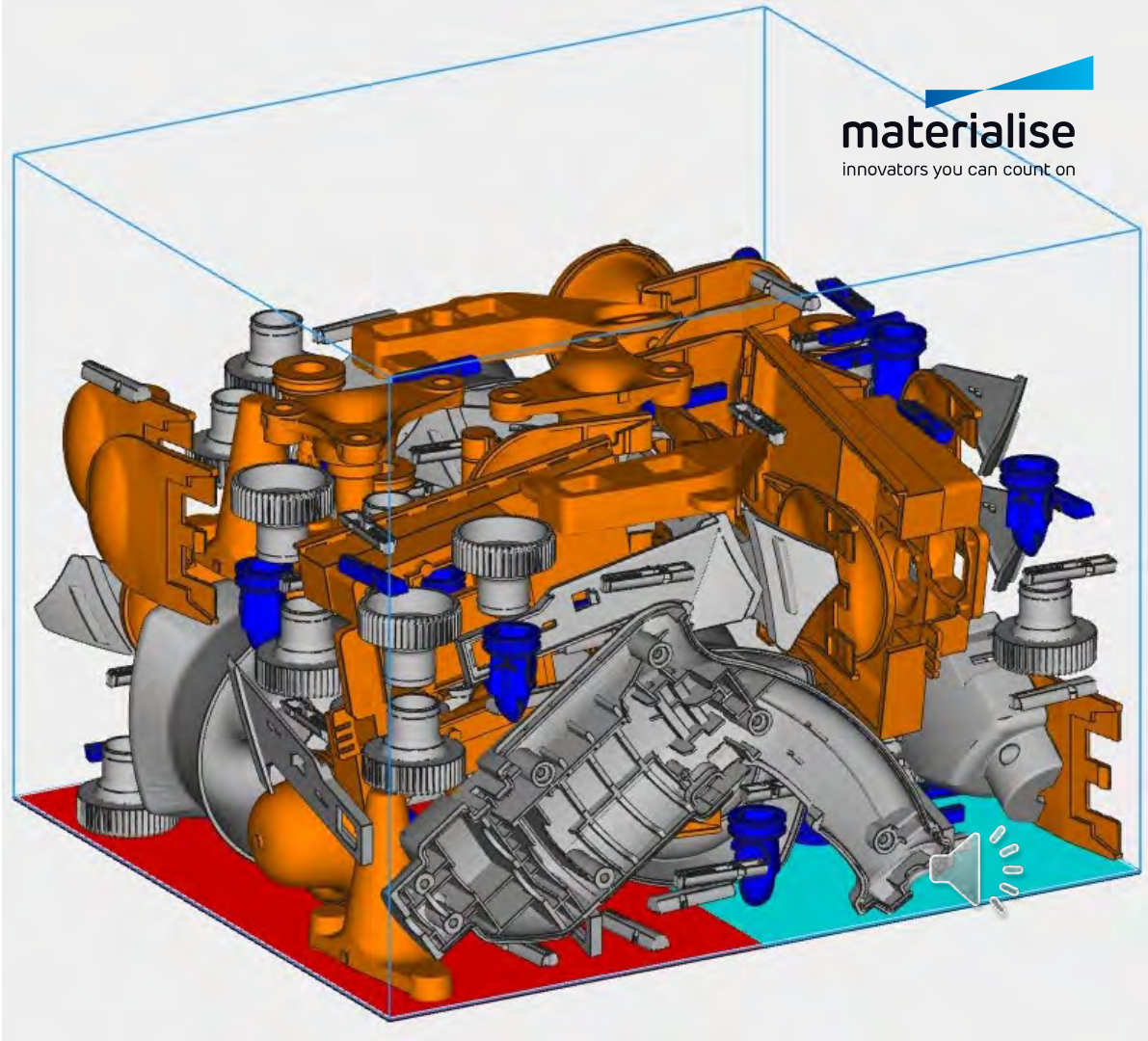
Optimize for Production

LS
Laser Sintering

PA, PA-GF, PA-Alu filled, TPU



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Optimize for Production

LS
Laser Sintering

PA, PA-GF, PA-Alu filled, TPU

- **Hollowing**
- **Minimizing build volume**
- **Depowdering holes**

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Optimize for Production

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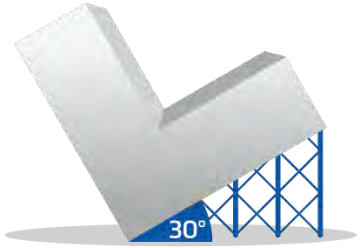
FDM
Fused Deposition Modeling

ABS, PC/ABS, PC, Ultem



Optimize for Production

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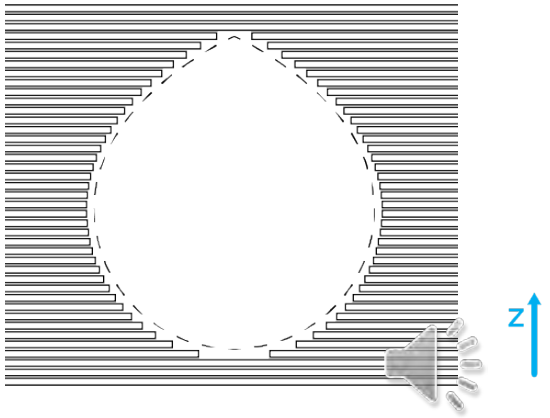
FDM
Fused Deposition Modeling

ABS, PC/ABS, PC, Ultem



Optimize for Production

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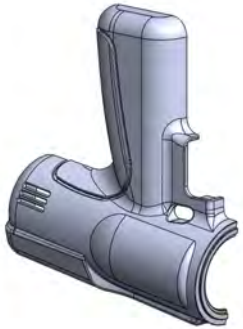
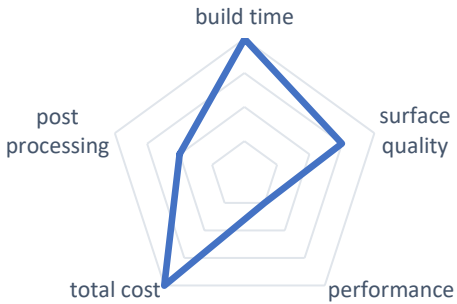
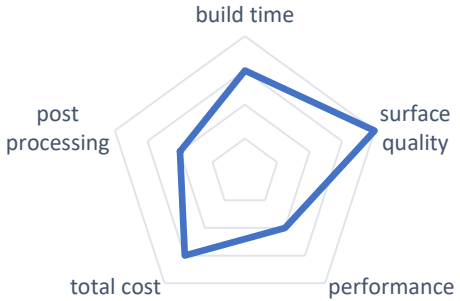
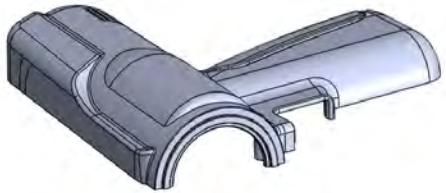
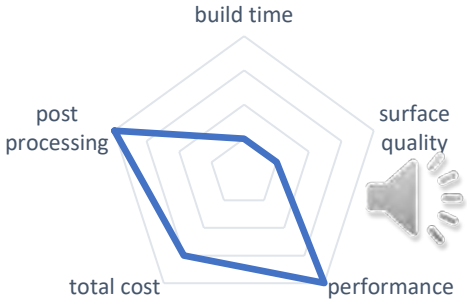
Impact of Build Orientation

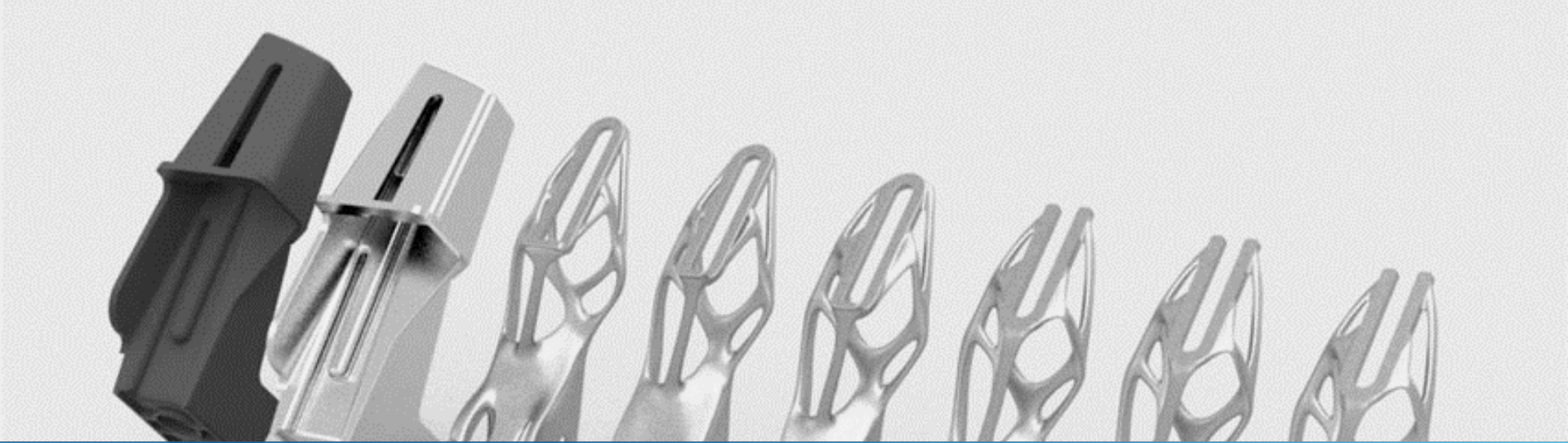












Impact of Design

Design for improvements and part performance

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Improving Part Performance

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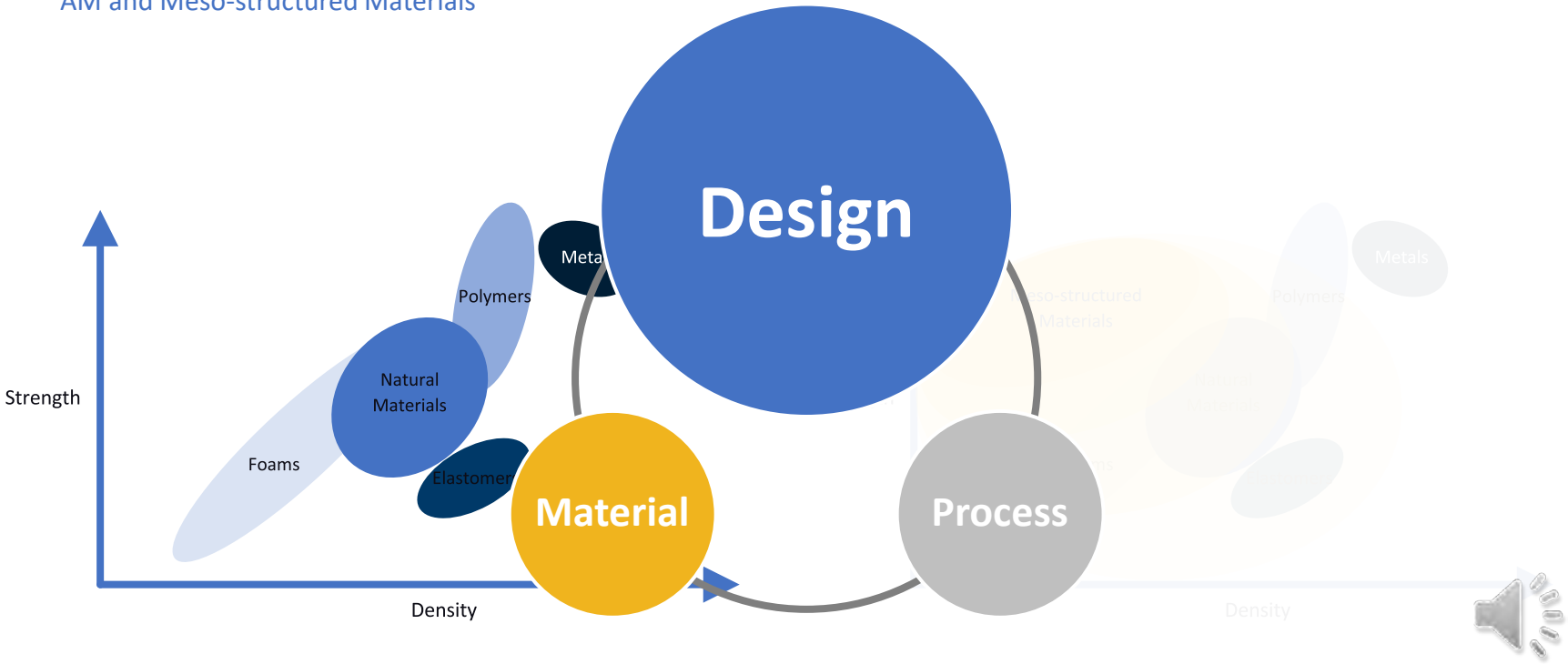
AM and Meso-structured Materials



Improving Part Performance

- **Maximize Strength/Weight ratio**
- **Enhance Part Performance**
- **Function Integration**

Improving Part Performance

- **Maximize Strength/Weight ratio**
  - **Topology optimization**

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Improving Part Performance

Topology optimization

- **Topology Optimization:**

Additive design approach to redesign a part using the design freedom that AM provides.

Improving Part Performance

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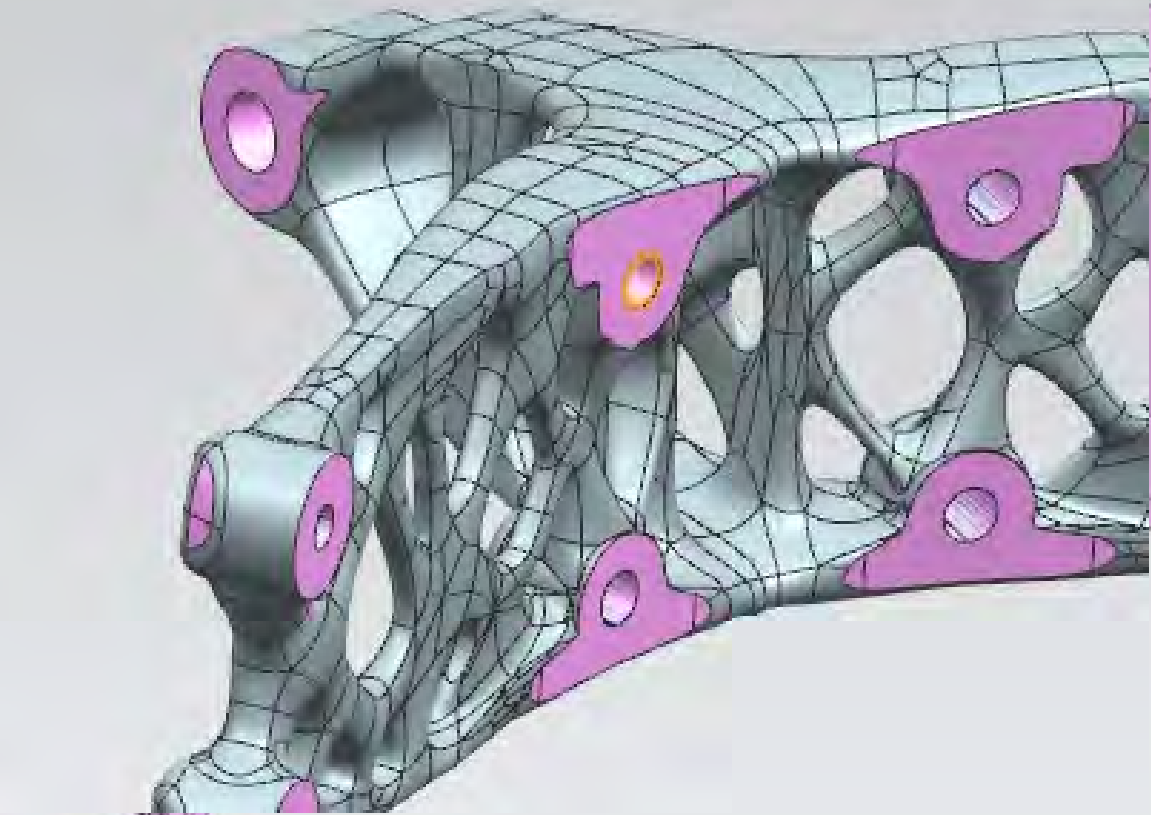
Topology optimization



- **Topology Optimization:**

Additive design approach to redesign a part using the design freedom that AM provides.

- Identify take over points/ boundary conditions
- Define design space
- Define load scenarios
- Run topology optimization
- Redesign part according to the topology optimized result.
- Validate the design with an FEA study

Improving Part Performance

- **Maximize Strength/Weight ratio**
  - **Topology optimization**
  - **Lattices**

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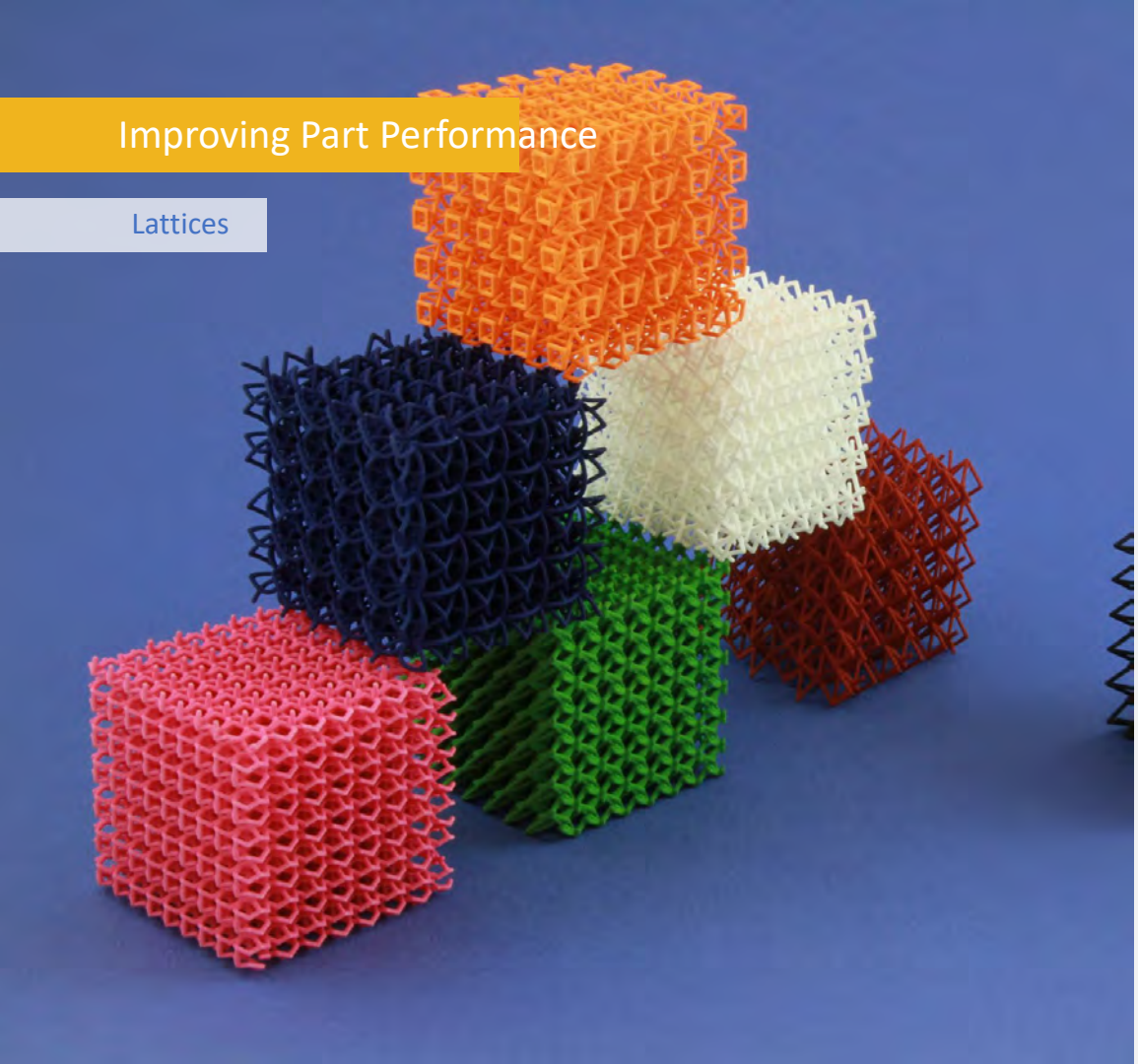

Improving Part Performance

Lattices

Design feature only possible in AM

- Decrease weight
- Flexibility
- Impact absorption
- Heat
- Esthetic design feature
- Different lattices with different properties:
  - Auxetic
  - Flexibility
  - Isotropic stiffness (gyroid)
  - Anisotropic stiffness (honeycomb)

Improving Part Performance

Lattices

Design feature only possible in AM

- Decrease weight
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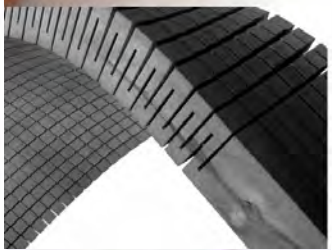
- Heat
- Esthetic design feature

Improving Part Performance

- **Maximize Strength/Weight ratio**
- **Enhance Part Performance**
  - **Textures**



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Improving Part Performance

Textures

- Added functionalities using surface texturing:
  - Acoustic dampening
  - Hide of build imperfections (staircase effect,...)
  - Add functionality without post-processing
  - Surface roughness

Improving Part Performance

- **Maximize Strength/Weight ratio**
- **Enhance Part Performance**
- **Function Integration**
  - **Compliant mechanisms**

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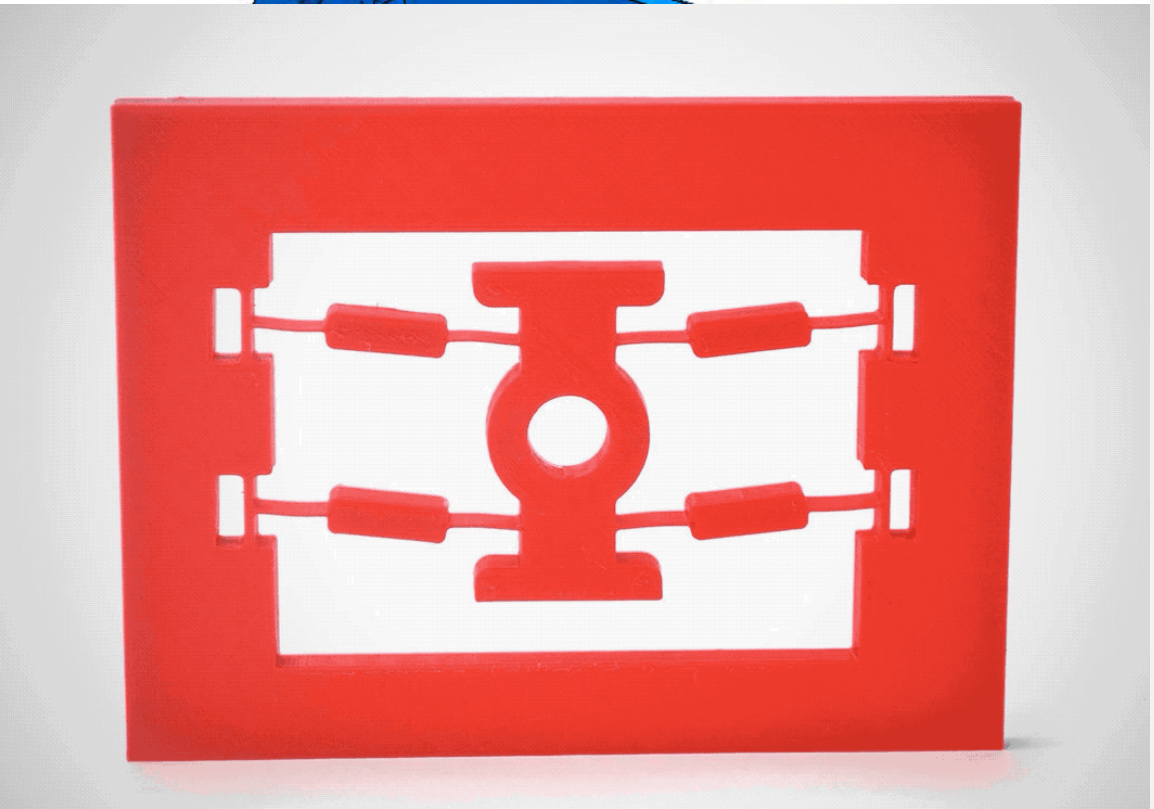
Improving Part Performance

Compliant mechanisms



- Use flexibility as a mechanism
- Parts consolidation
- Reduce assembly cost

What determines performance?

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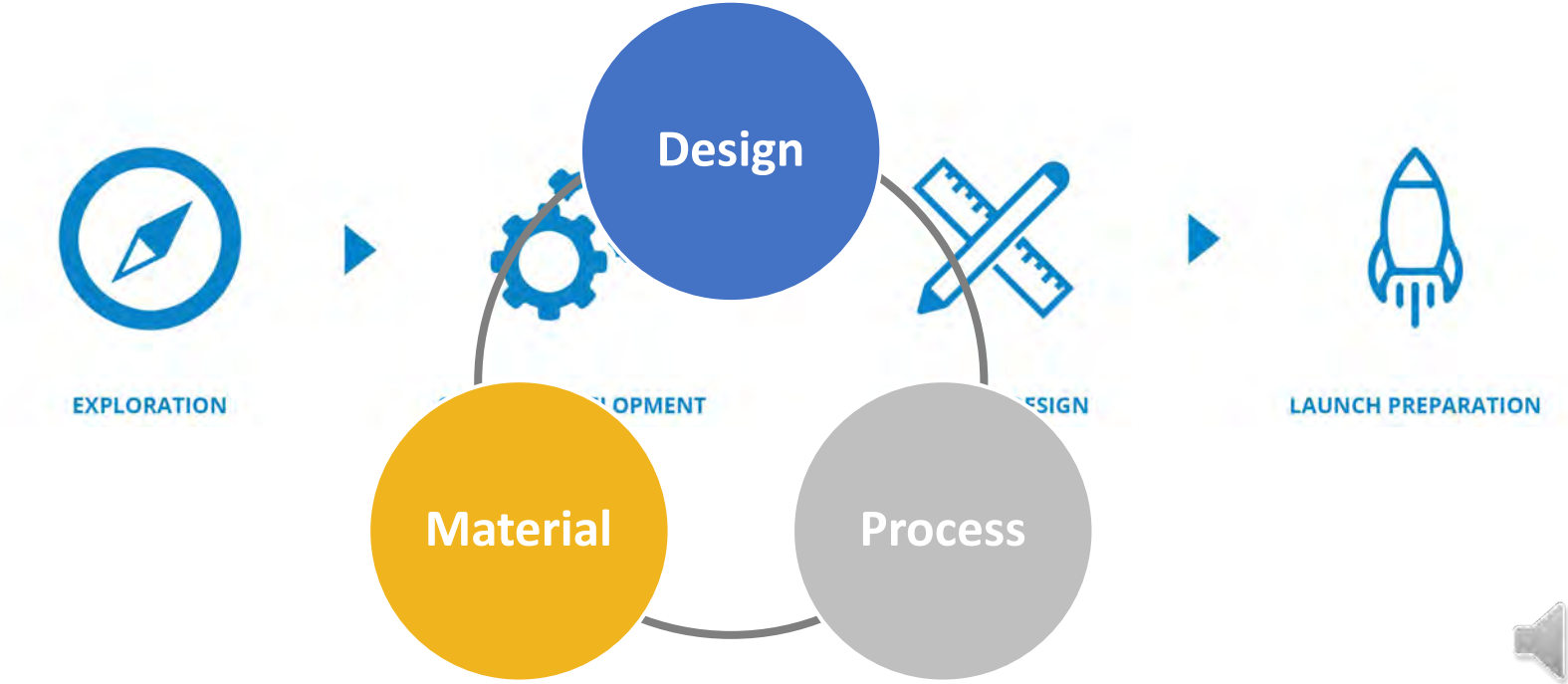

Contact information
Technical questions

Nicolas Meiresonne
Design Engineer
Nicolas.meiresonne@materialise.be

Materialise NV
Technologielaan 15
3001 Leuven, Belgium

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