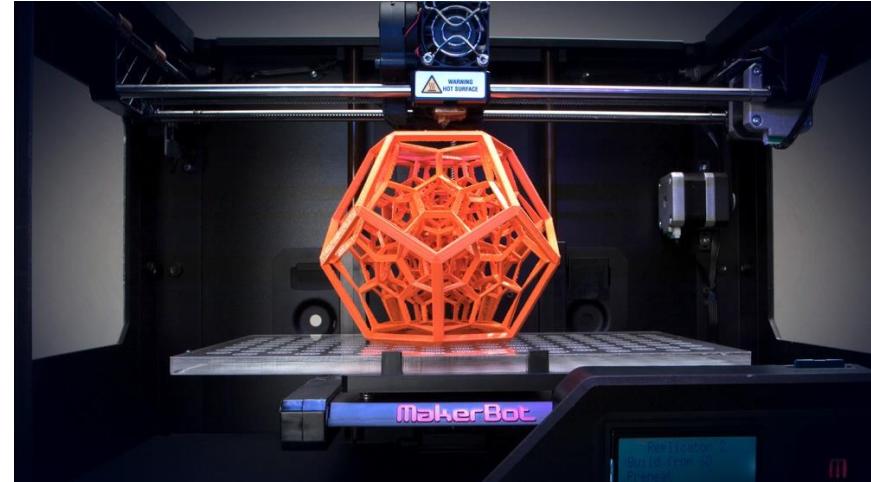


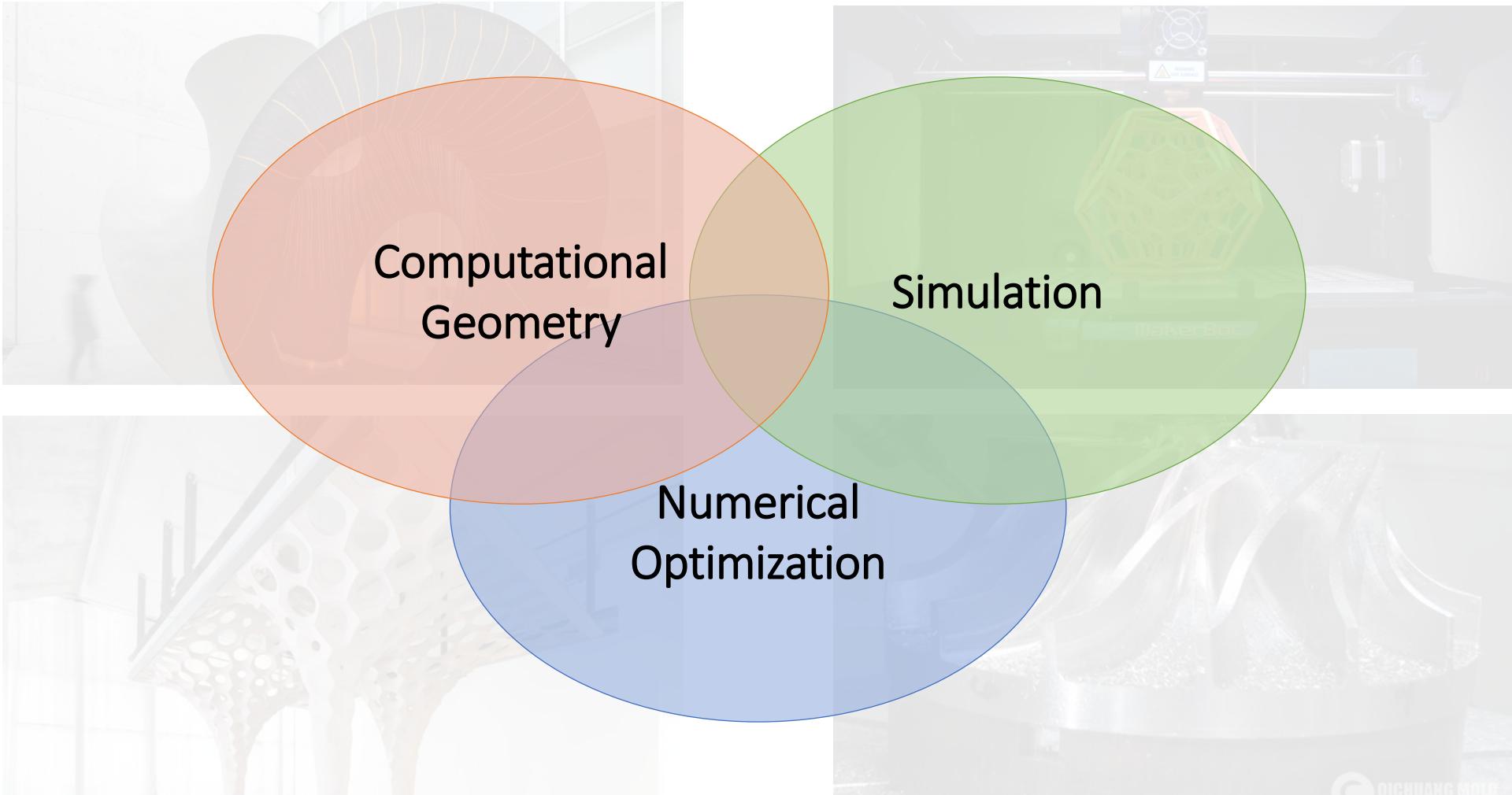
Computational Methods for Improving Manufacturing Processes

Thomas Alderighi

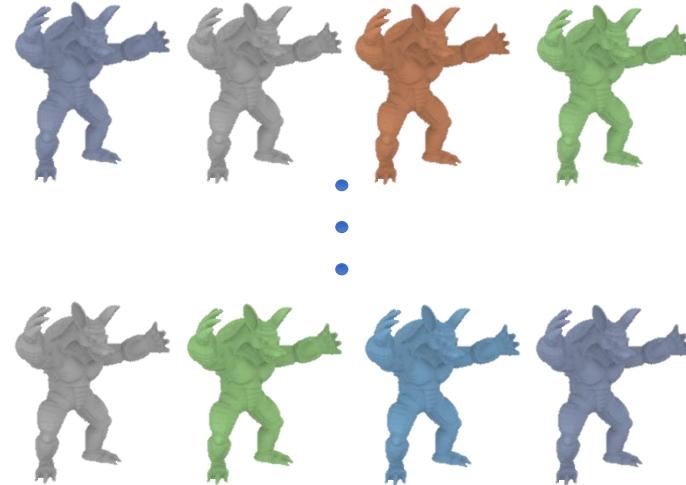
Computational Fabrication



Computational Fabrication

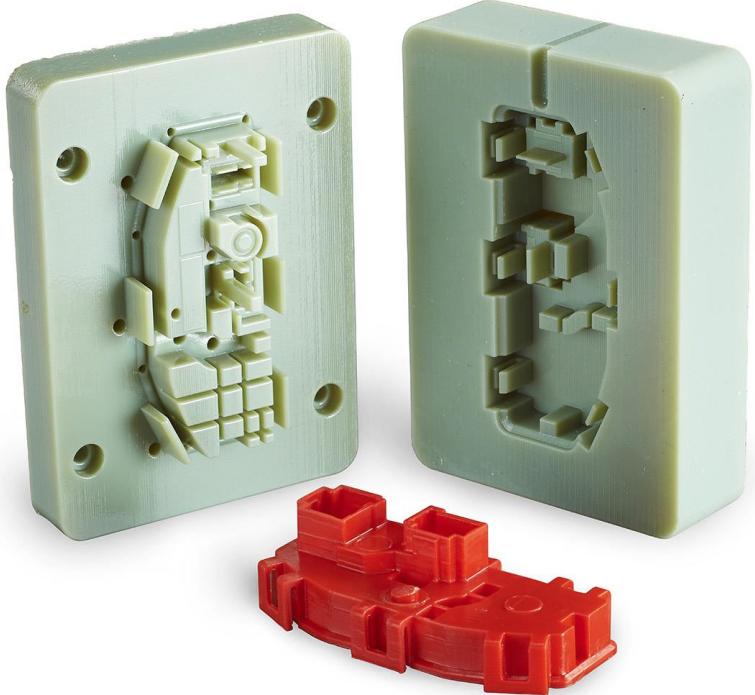


Limited Series Fabrication of Complex Objects



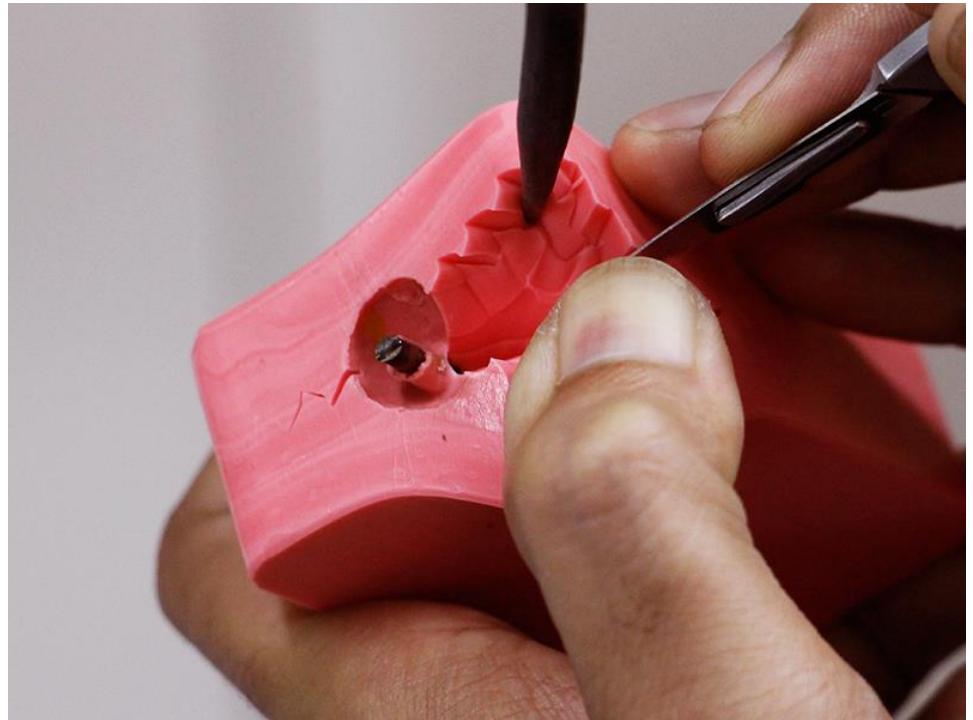
- Multiple copies
- Time and cost-efficient fabrication
- Wide range of materials

Molding



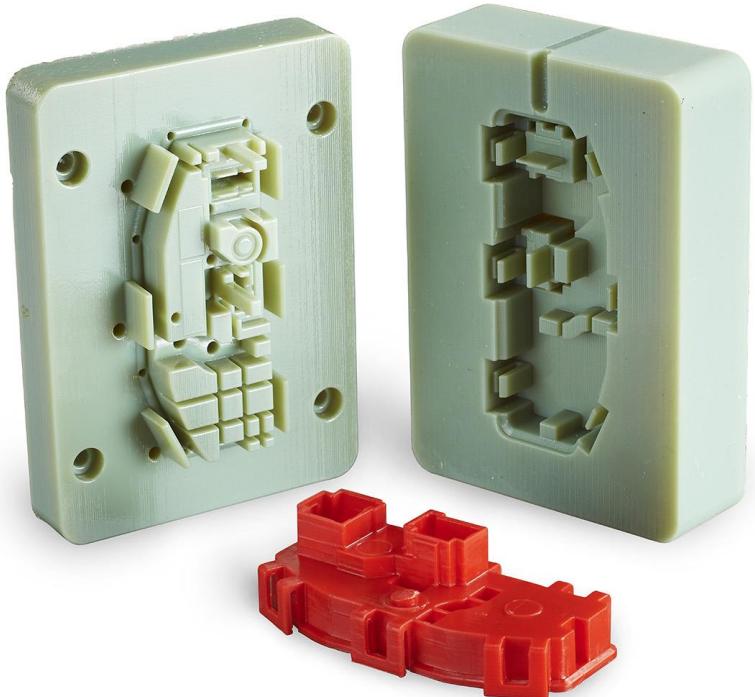
Rigid

- Multiple copies 😊
- Time and cost-efficient fabrication 😊
- Wide range of materials 😊



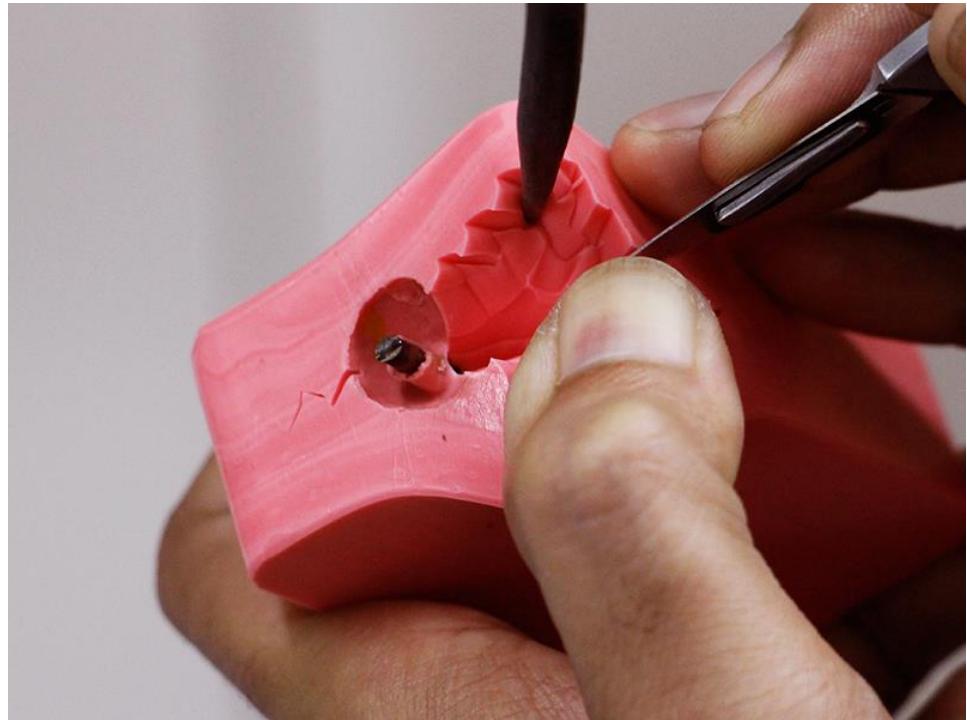
Soft

Molding



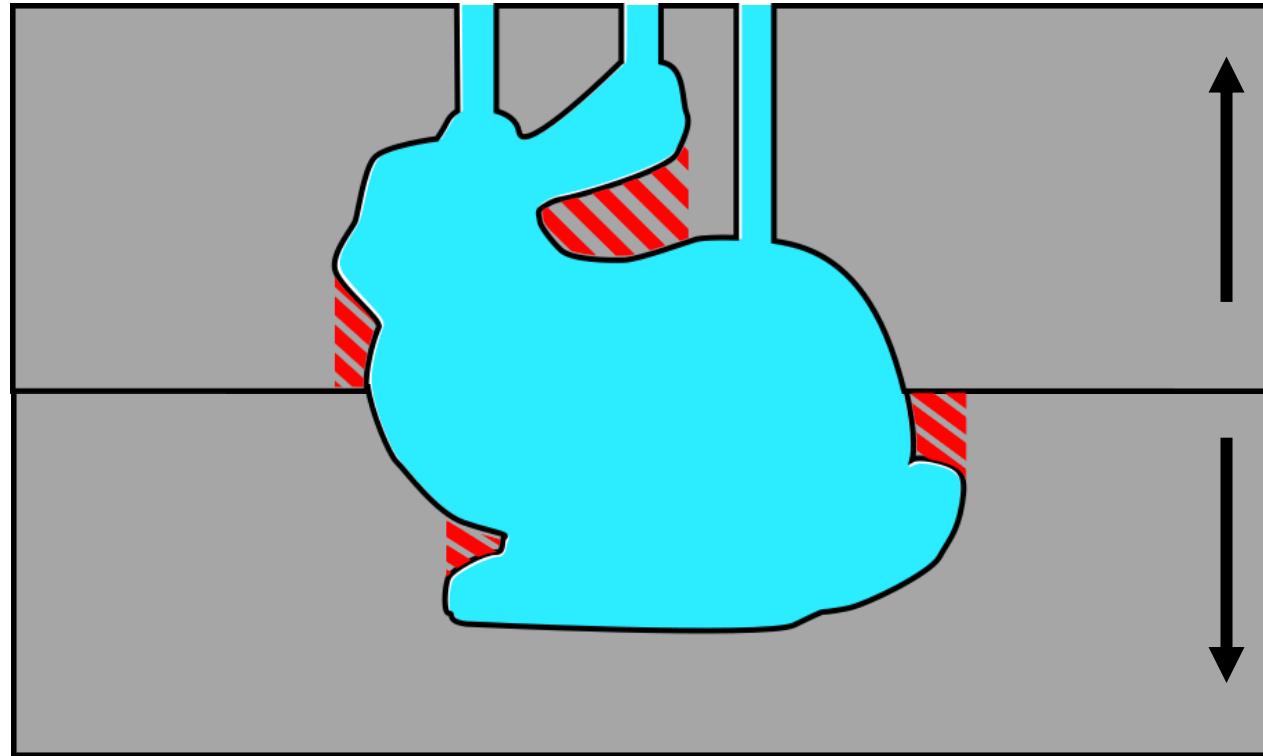
Rigid

- Multiple copies 😊
- Time and cost-efficient fabrication 😊
- Wide range of materials 😊



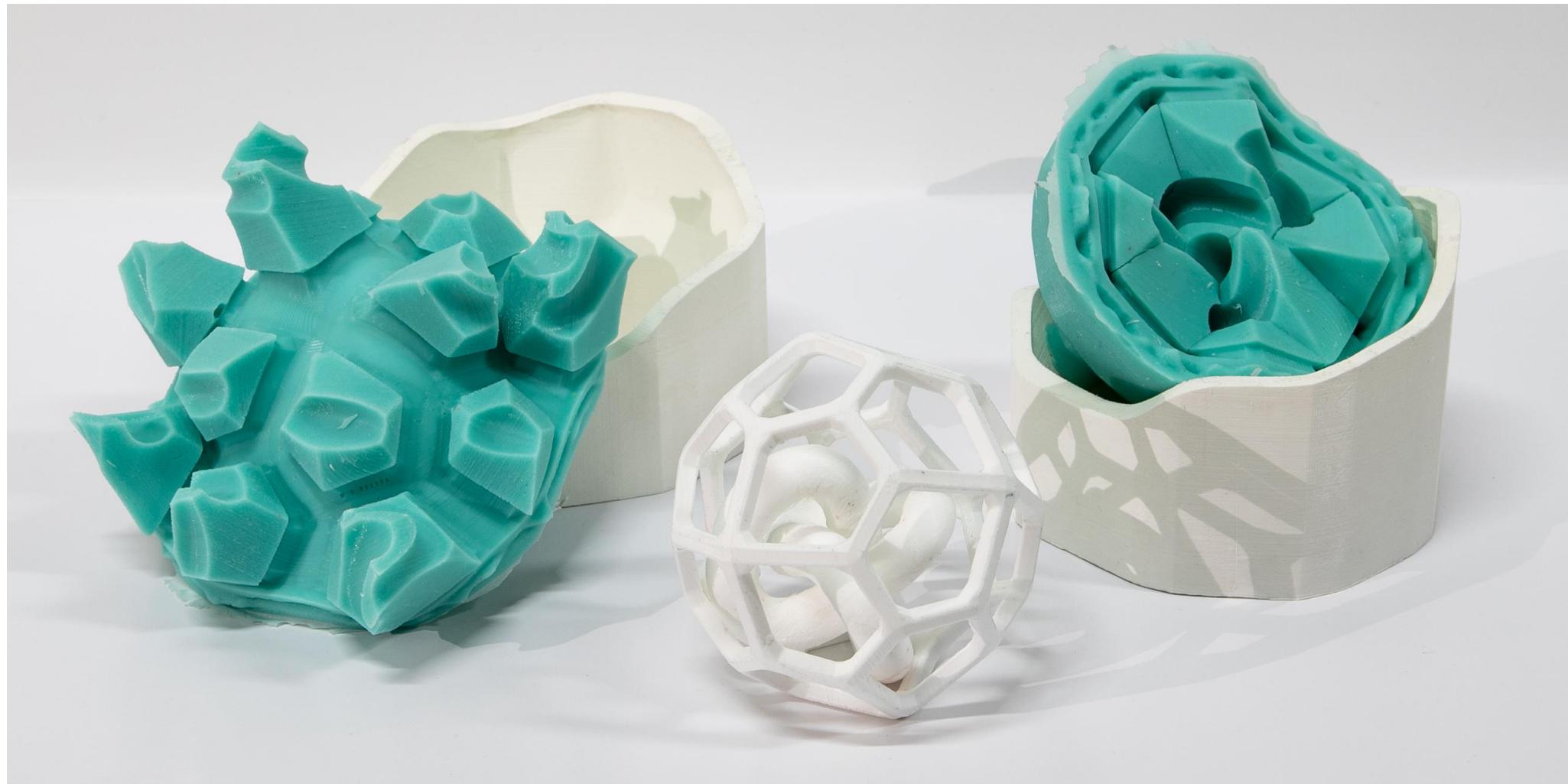
Soft

Molding Constraints



Undercuts ($n \cdot p \cdot d_{ext} < 0$) impose hard constraints for rigid molding or rigid molding

Generate flexible molds for complex objects



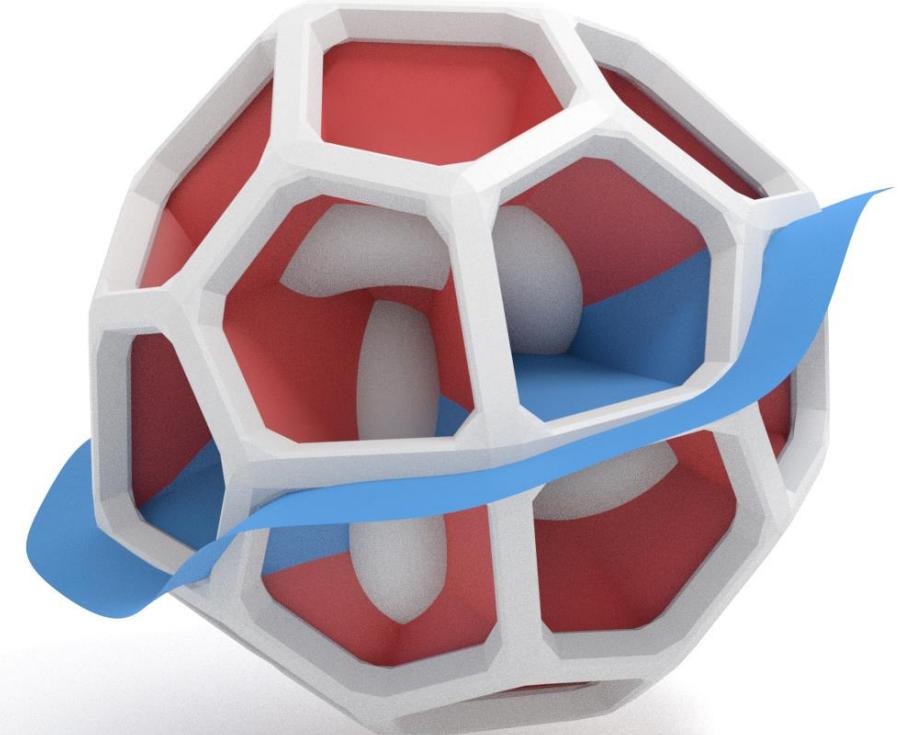
Pentagonal Icositetrahedron courtesy by Laura Taalman

Generate flexible molds for complex objects

How do you define a valid mold?

What cuts are needed to release the object?

How can you compute this in a robust way?



Pentagonal Icositetrahedron courtesy by Laura Taalman

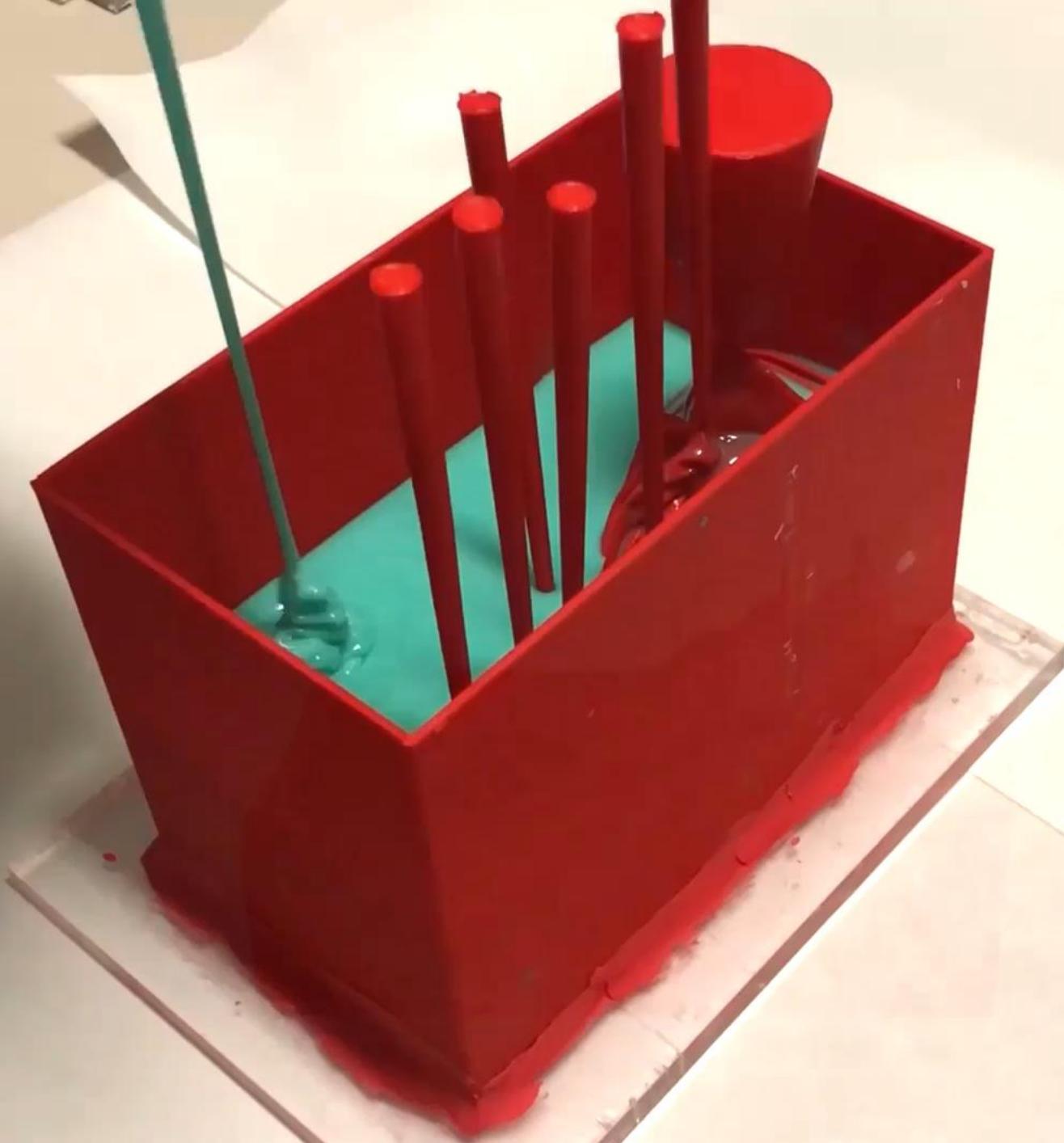
Metamolds: computational design of silicone molds

Thomas Alderighi, Luigi Malomo, Daniela Giorgi, Nico Pietroni, Bernd Bickel, Paolo Cignoni

ACM Transactions on Graphics
Volume 37, Number 4, August 2018



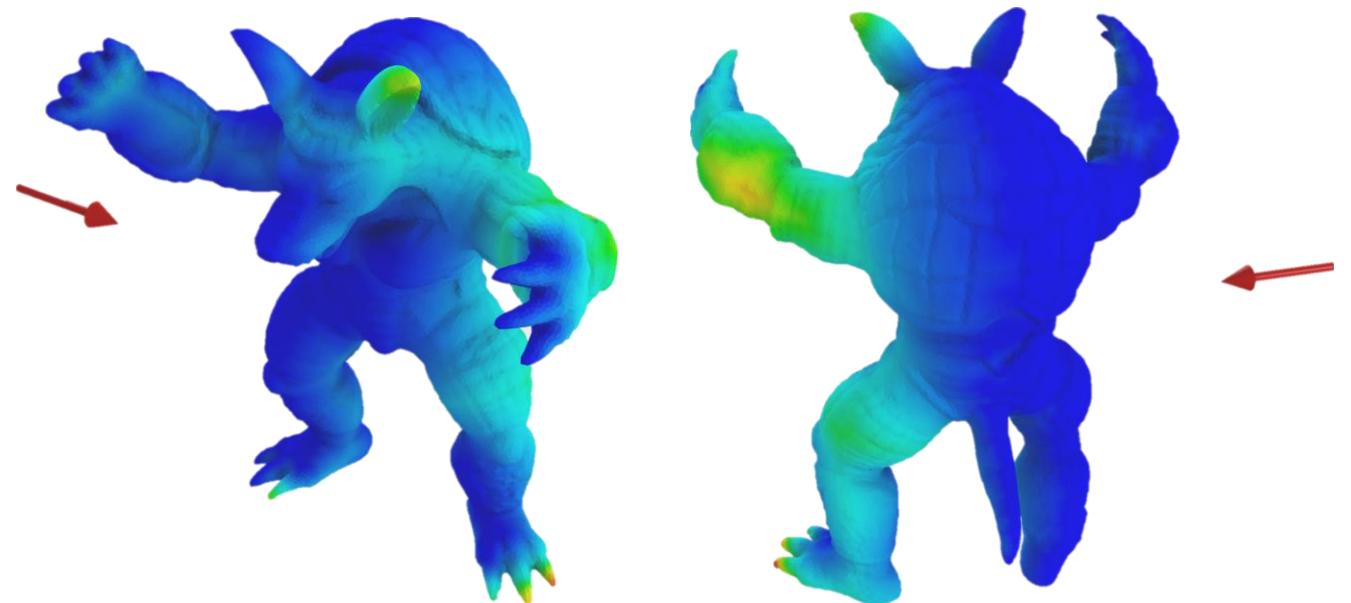
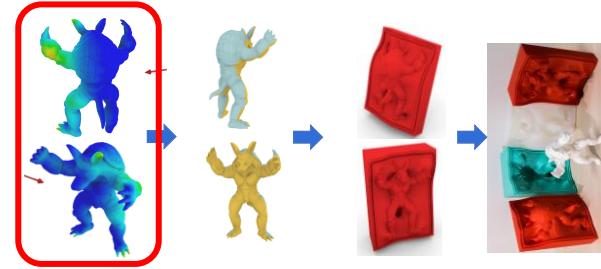
Thomas Alderighi



Pipeline

Given an input 3D Mesh:

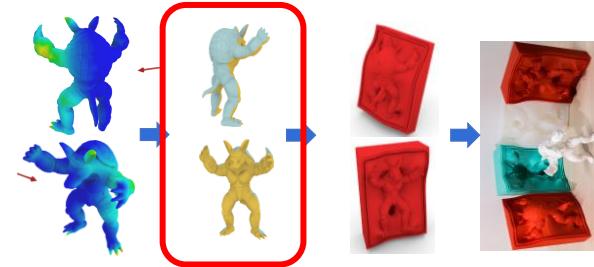
- Moldability Field Estimation



Pipeline

Given an input 3D Mesh:

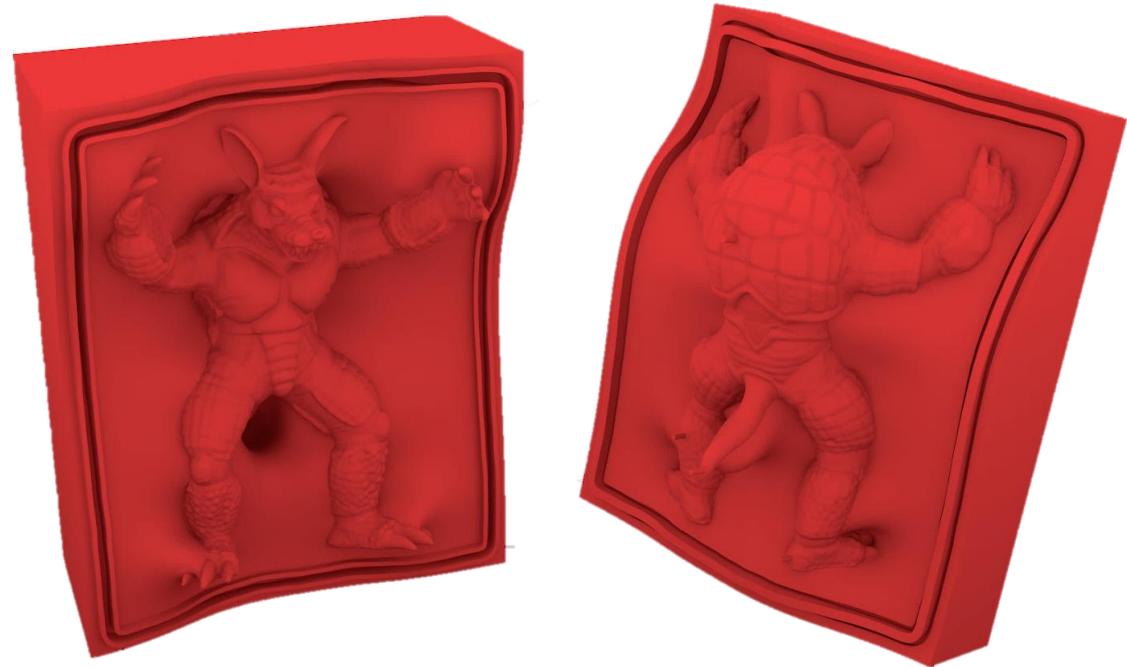
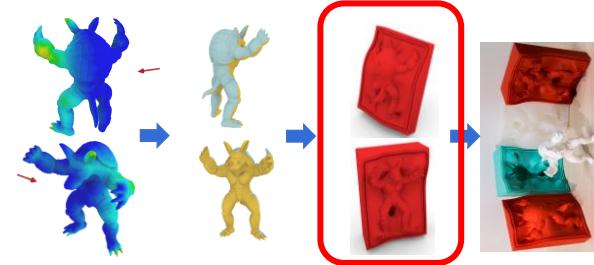
- Moldability Field Estimation
- Surface Decomposition



Pipeline

Given an input 3D Mesh:

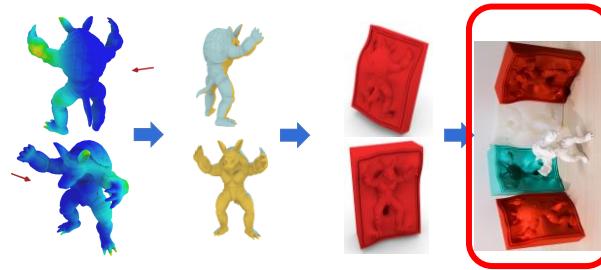
- Moldability Field Estimation
- Surface Decomposition
- Metamolds Generation



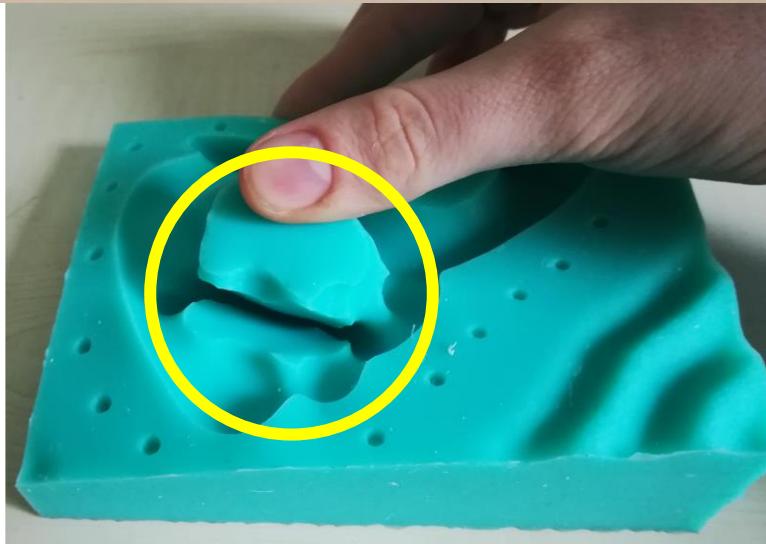
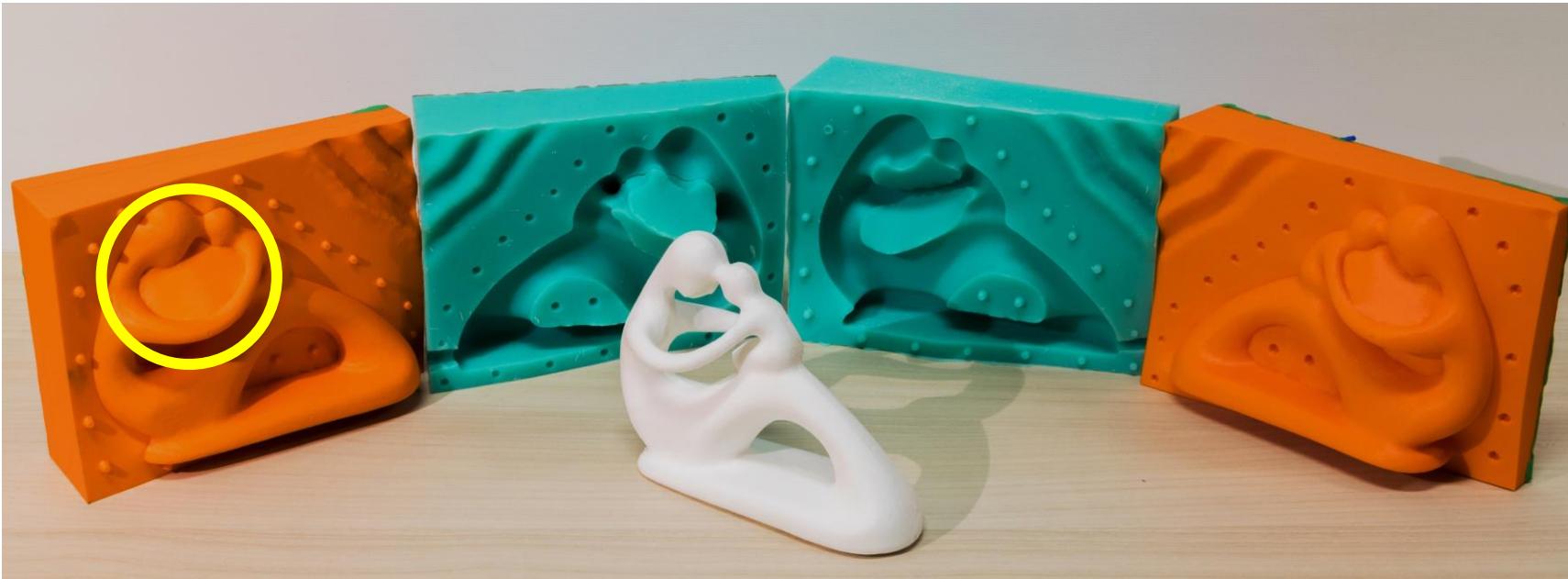
Pipeline

Given an input 3D Mesh:

- Moldability Field Estimation
- Surface Decomposition
- Metamolds Generation
- Fabrication



Addressing Topological Complexity



Silicone Molding Issues



Topological and geometrical features are still issues with silicone molds

Silicone Molding Issues



Topological and geometrical features are still issues with silicone molds

Silicone Molding Issues



Topological and geometrical features are still issues with silicone molds

Volume-Aware Design of Composite Molds

Thomas Alderighi, Luigi Malomo, Daniela Giorgi, Bernd Bickel, Paolo Cignoni, Nico Pietroni

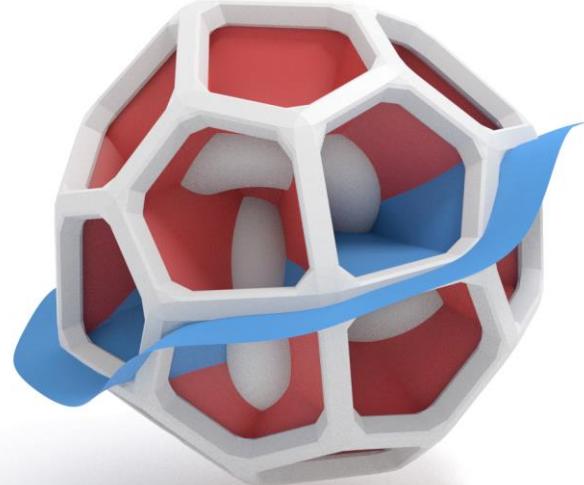
ACM Transactions on Graphics
Volume 38, Number 4, page 12 - July 2019



Pipeline

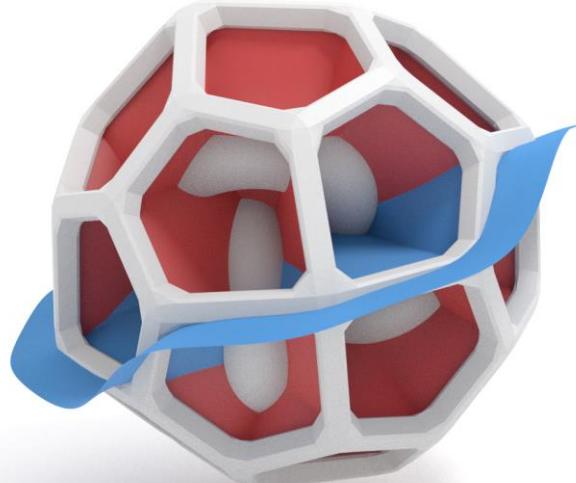


Pipeline



Cutting surfaces

Pipeline



Cutting surfaces



Metamolds

Pipeline



Cutting surfaces

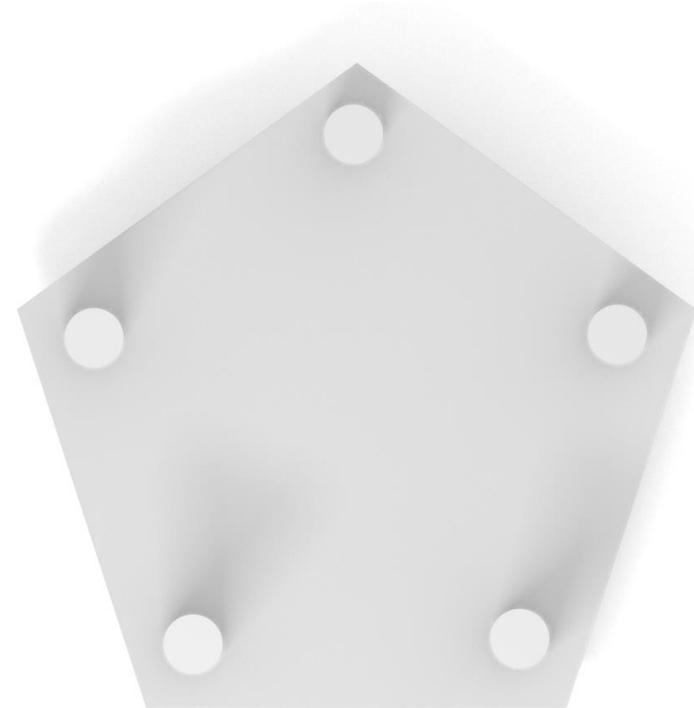


Metamolds

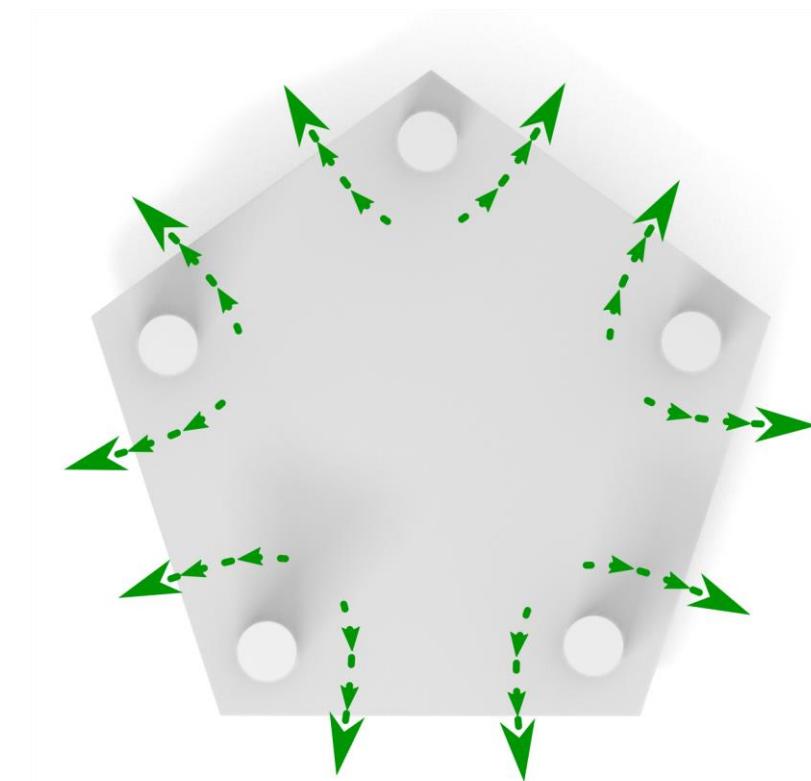


Composite Molds

Method Intuition

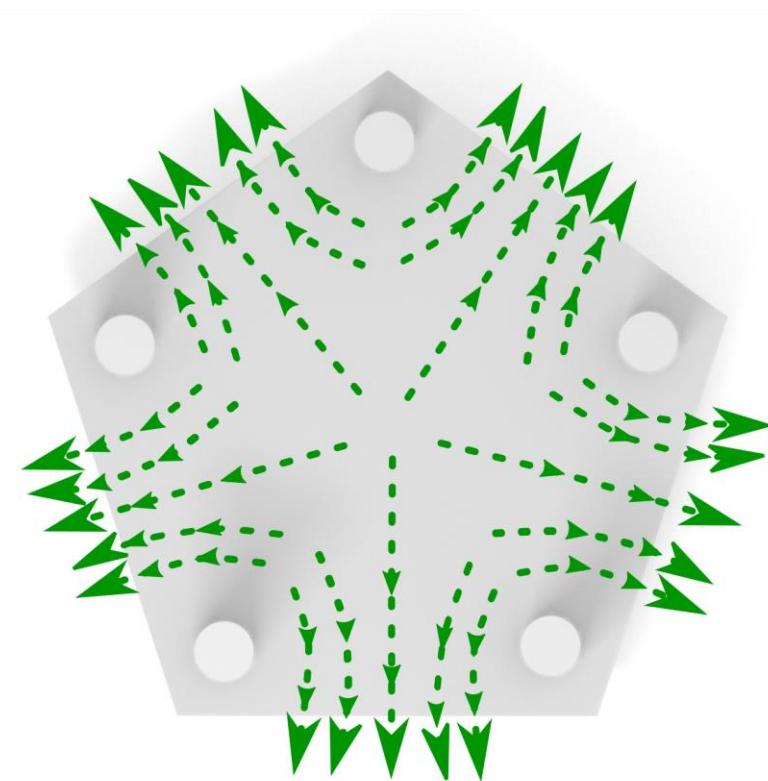


Method Intuition



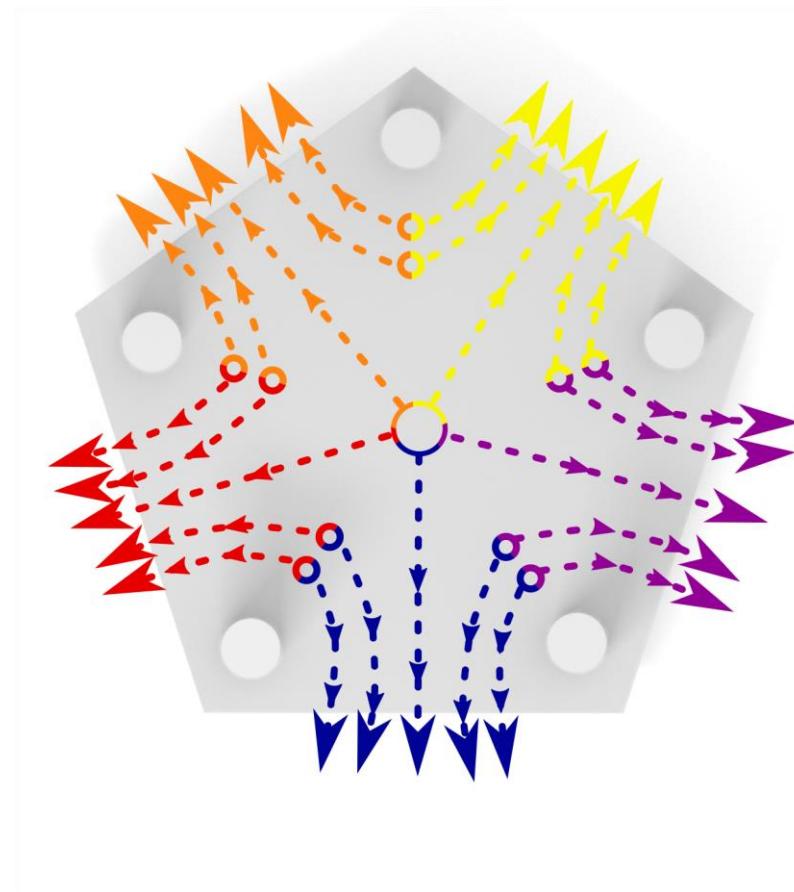
Escape Paths

Method Intuition

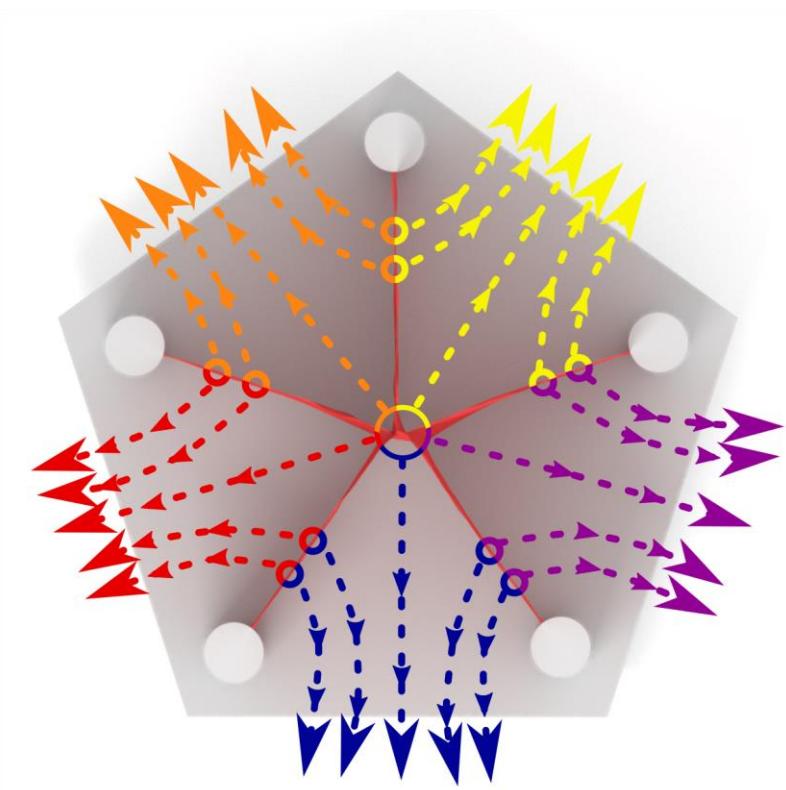


Escape Paths

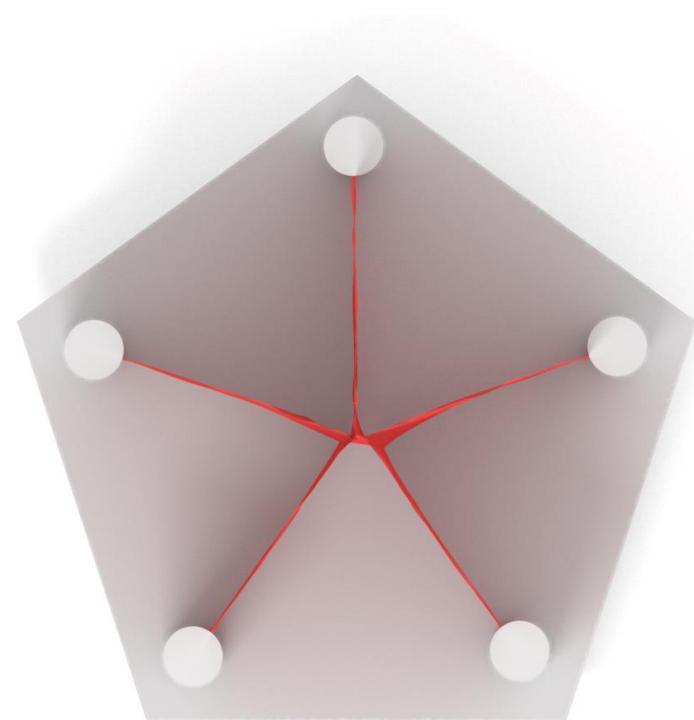
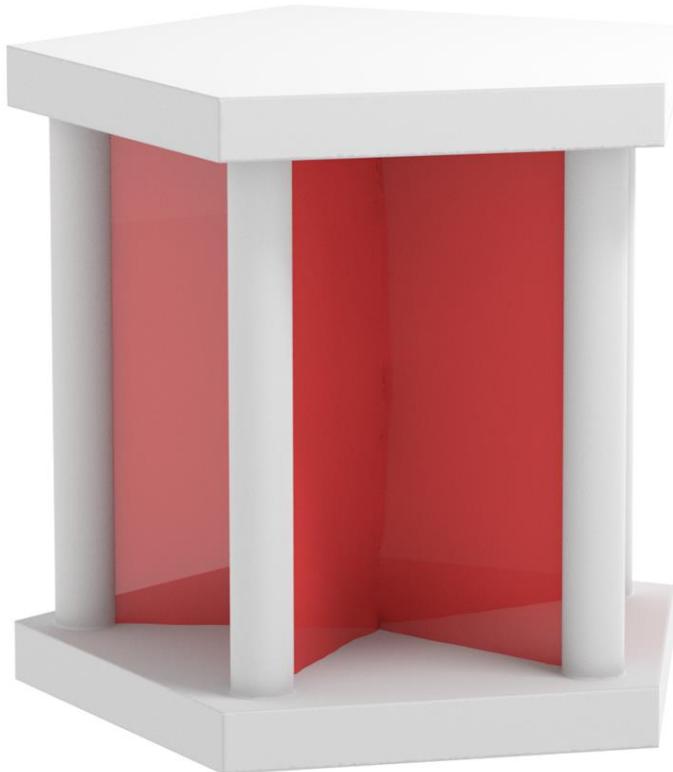
Method Intuition



Method Intuition

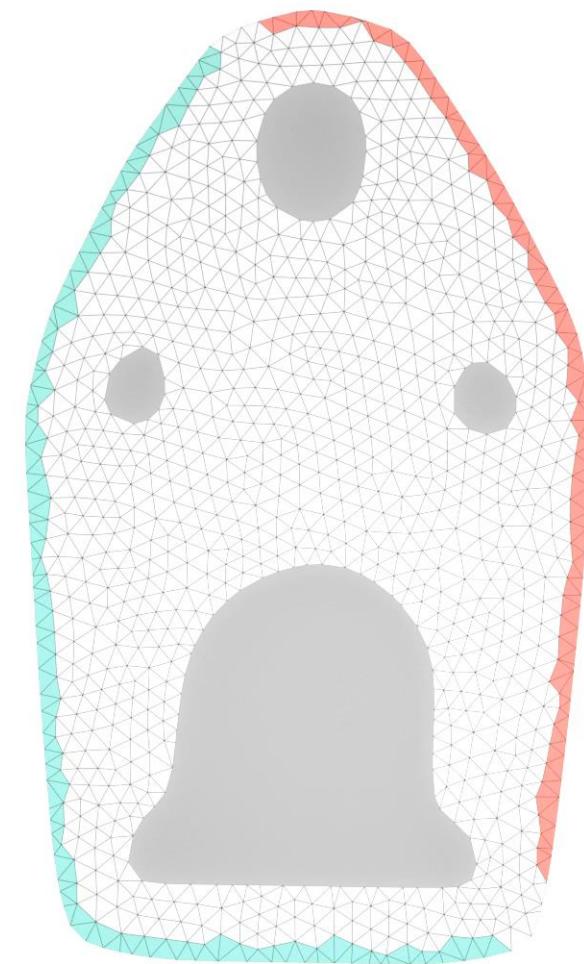


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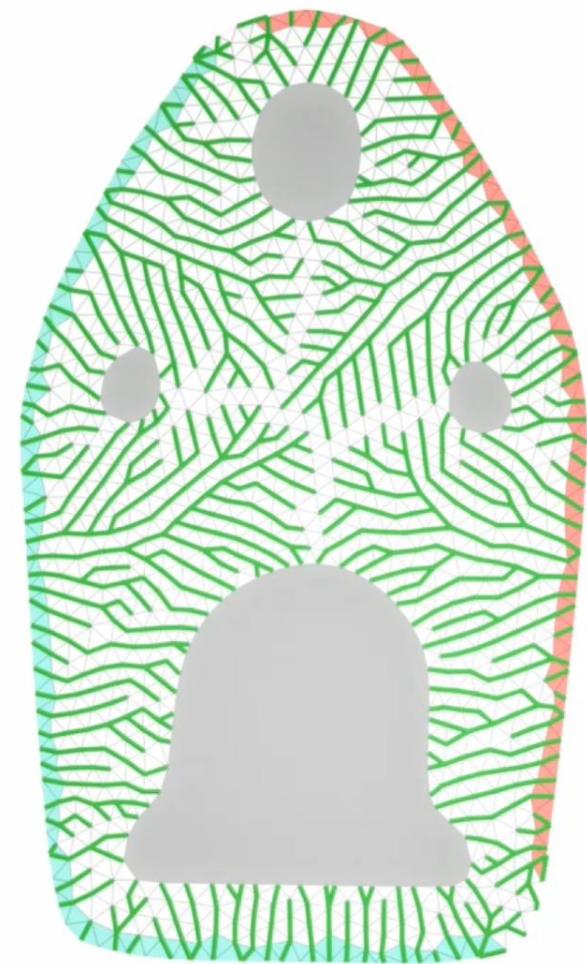
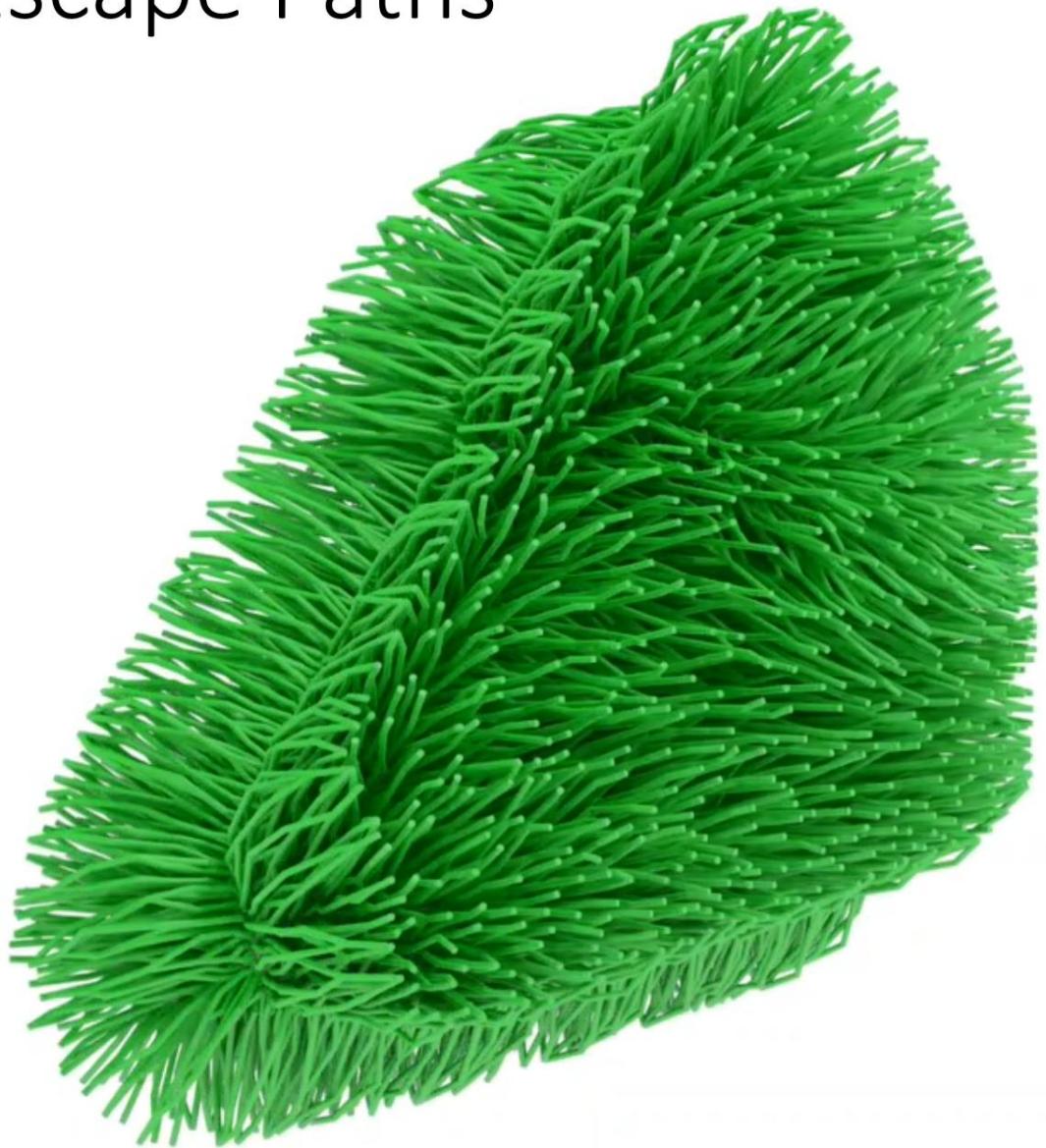


Cut Surface

Escape Paths

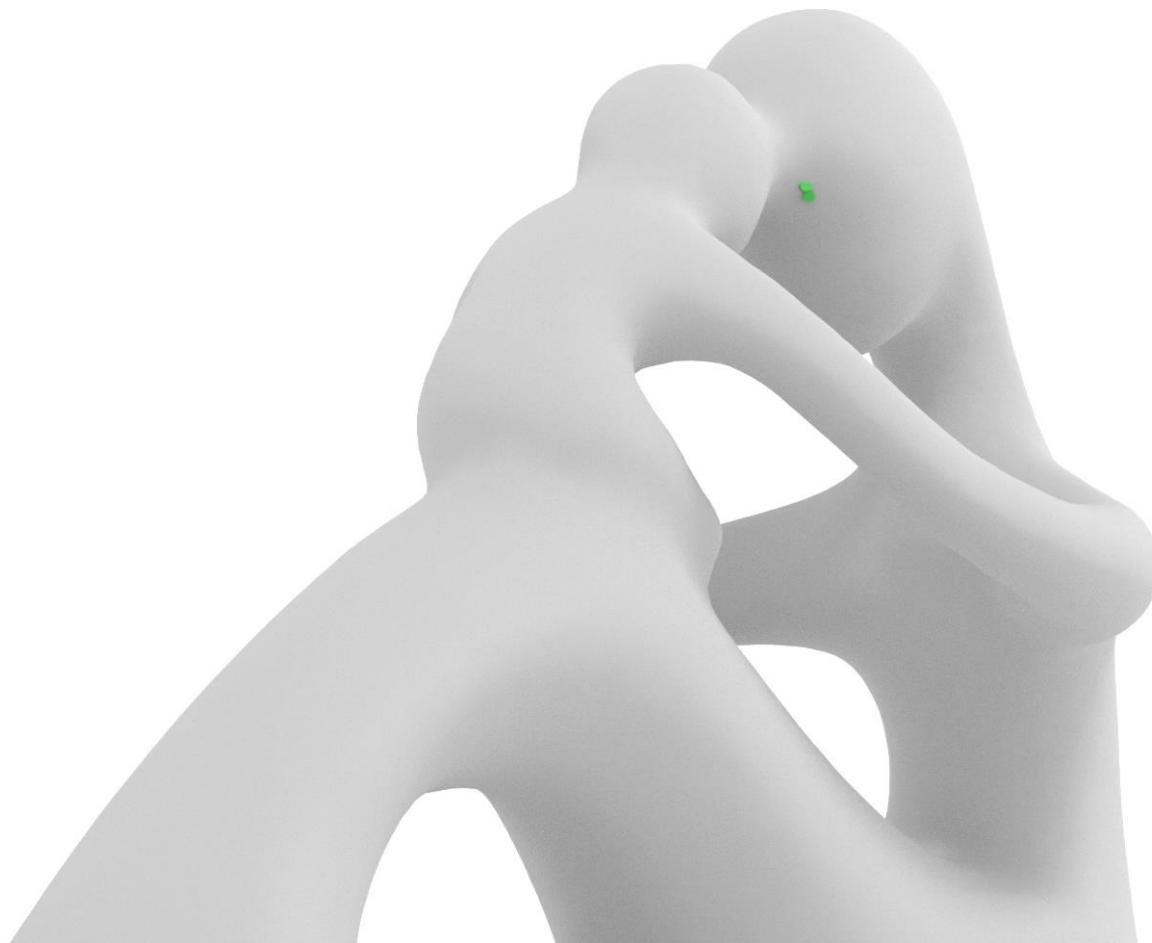


Escape Paths

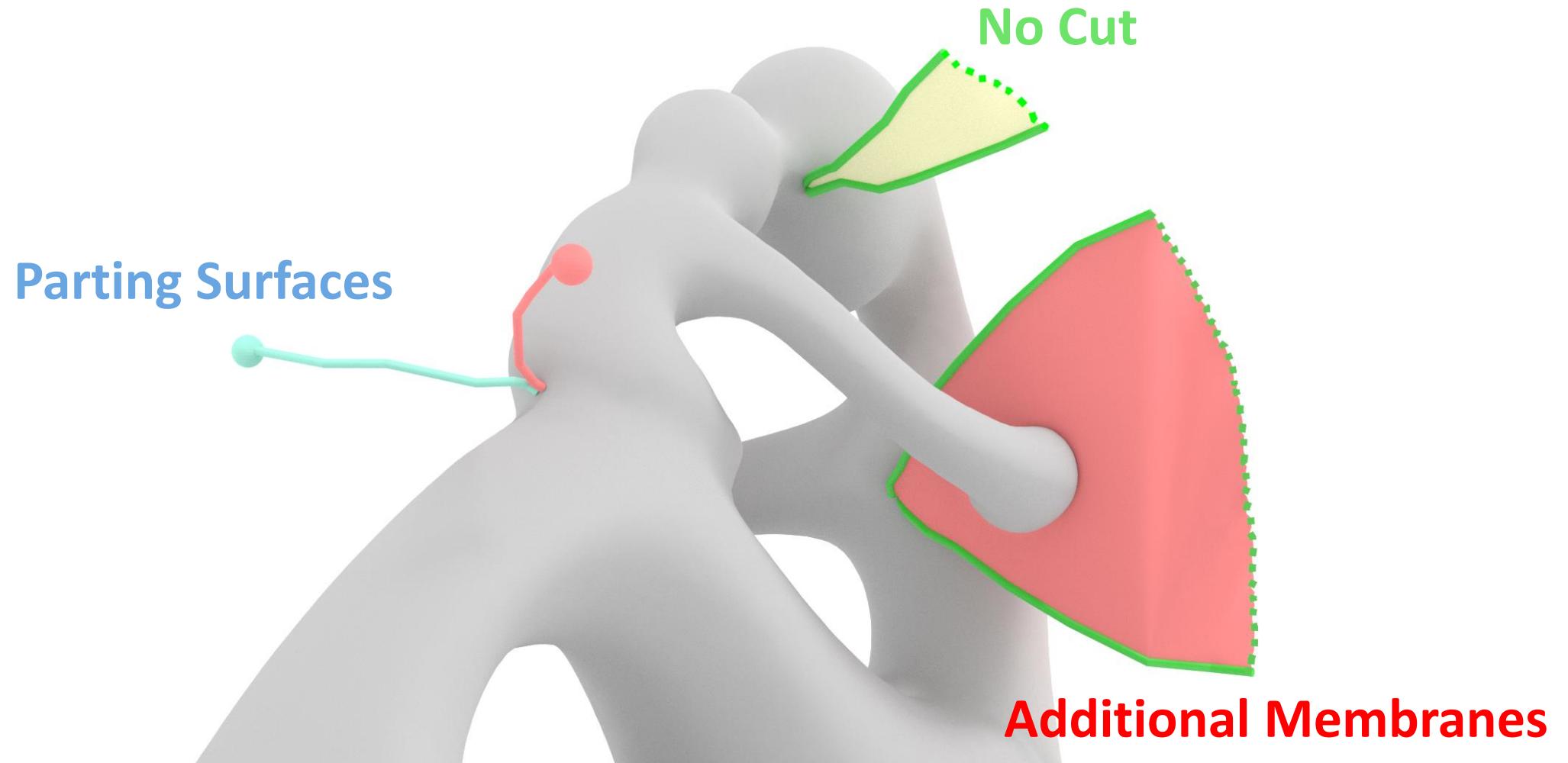


Thomas Alderighi

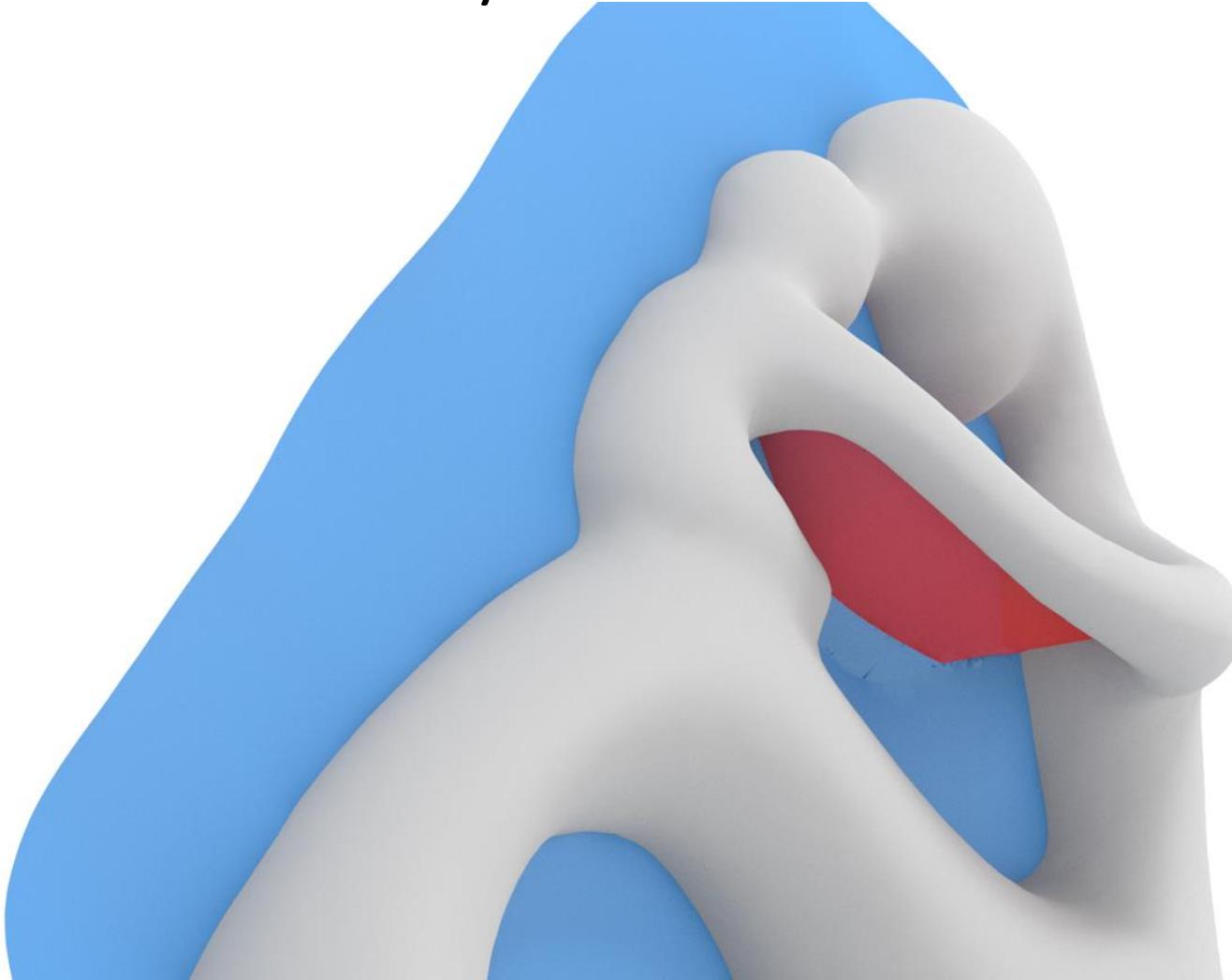
Escape Paths Analysis



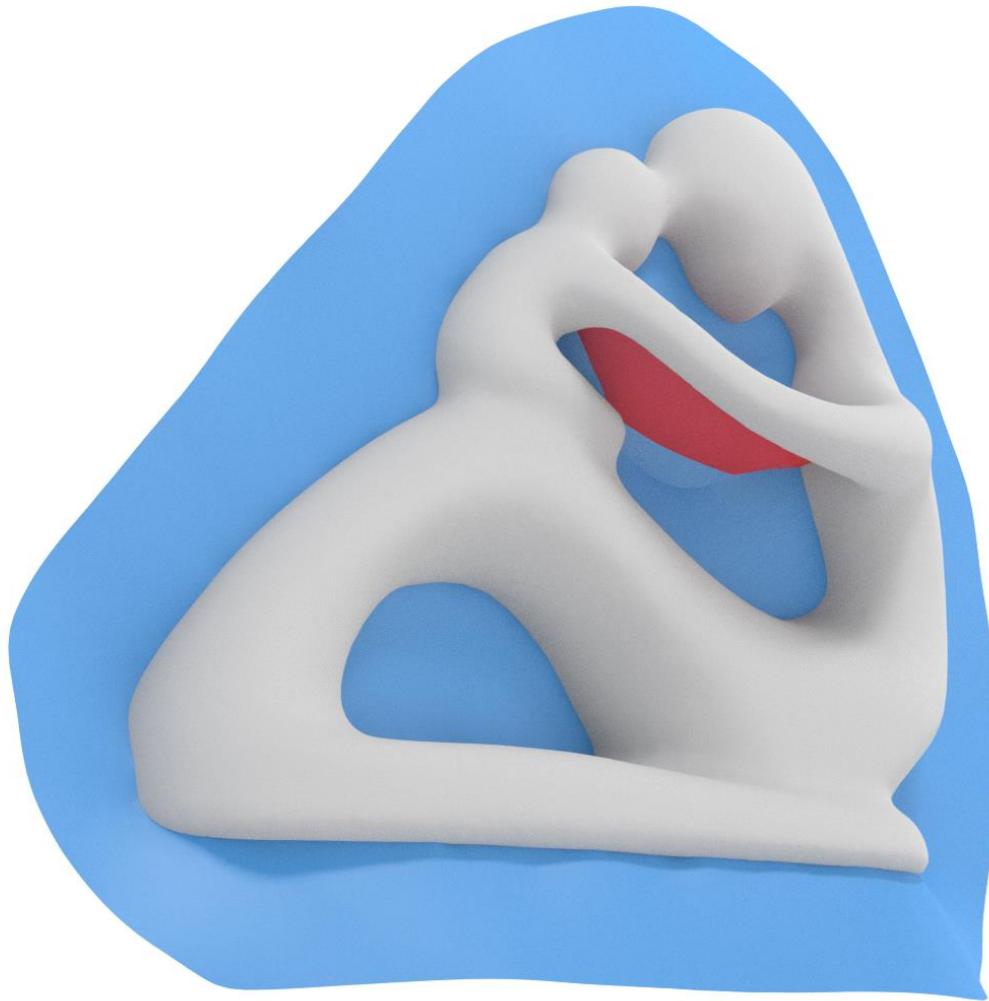
Escape Paths Analysis



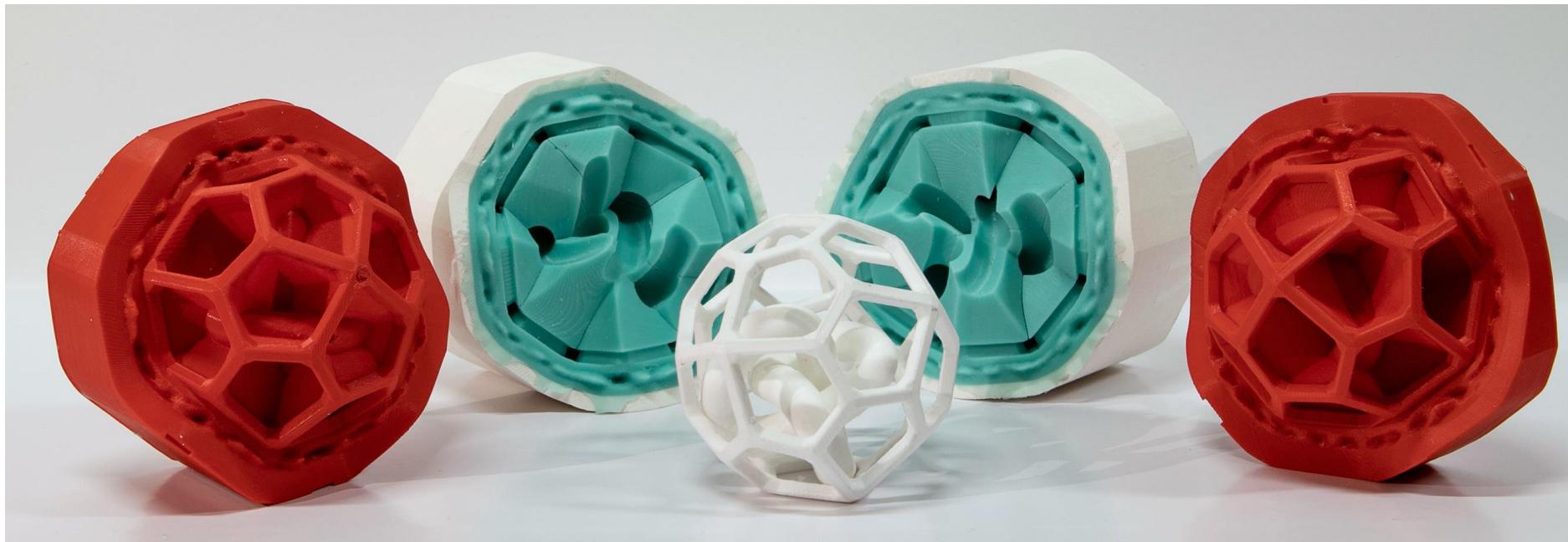
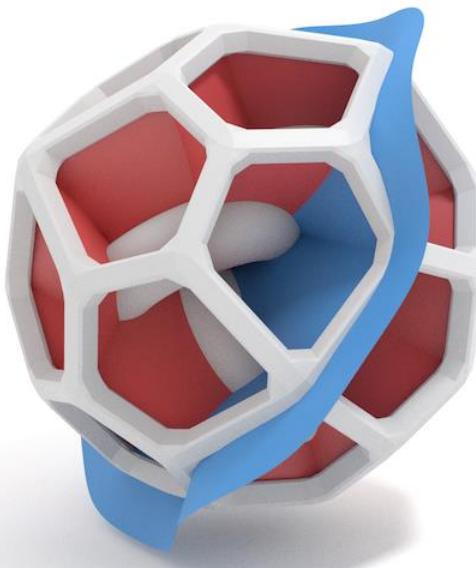
Escape Paths Analysis



Escape Paths Analysis



Results



Results



Results

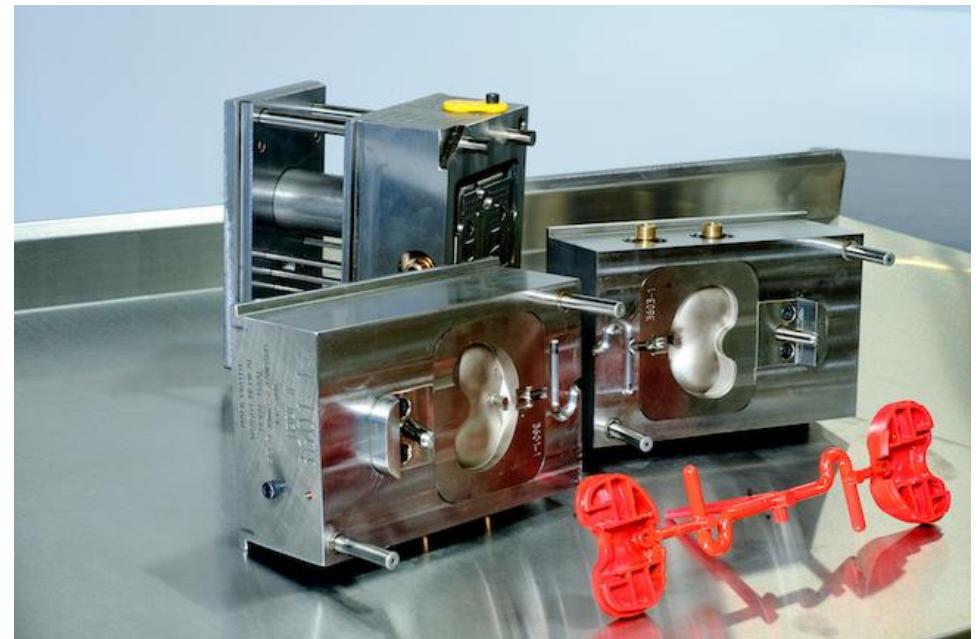


What's next?

From...



To...



From an inherently manual (artisanal) to industrial manufacturing processes

What's next?

Robust Height-Field Decomposition



Double Height-Field Decomposition

