

Proposal by:
Digital Craft Lab | California College of the Arts
Team: Negar Kalantar, PhD + Parham Nourikoupaei + Erfan Rezaei

reTERNAL

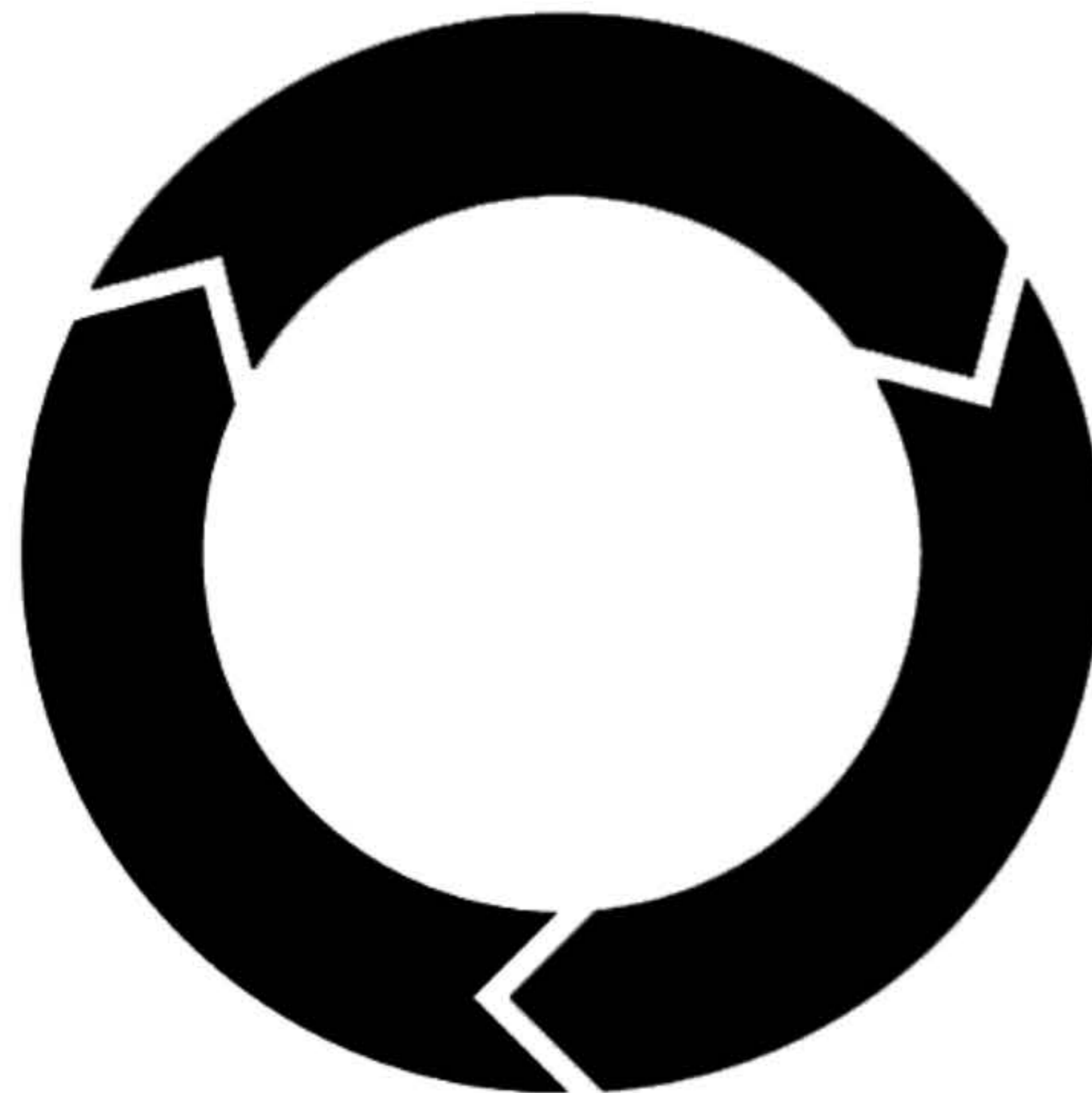




LINEAR ECONOMY

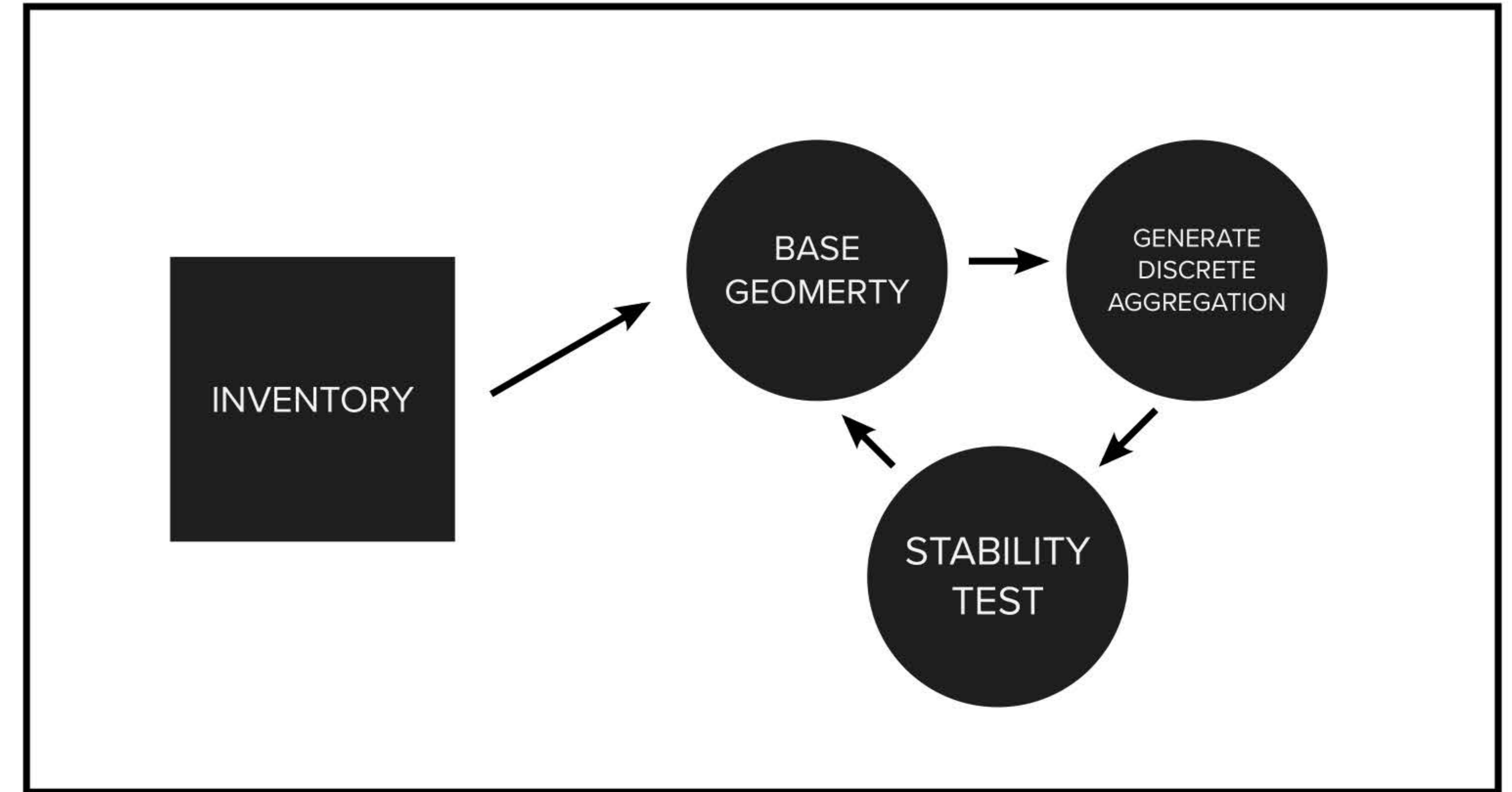
MAKE
REFURBISH
REPAIR

REUSE
REPURPOSE
RECYCLE

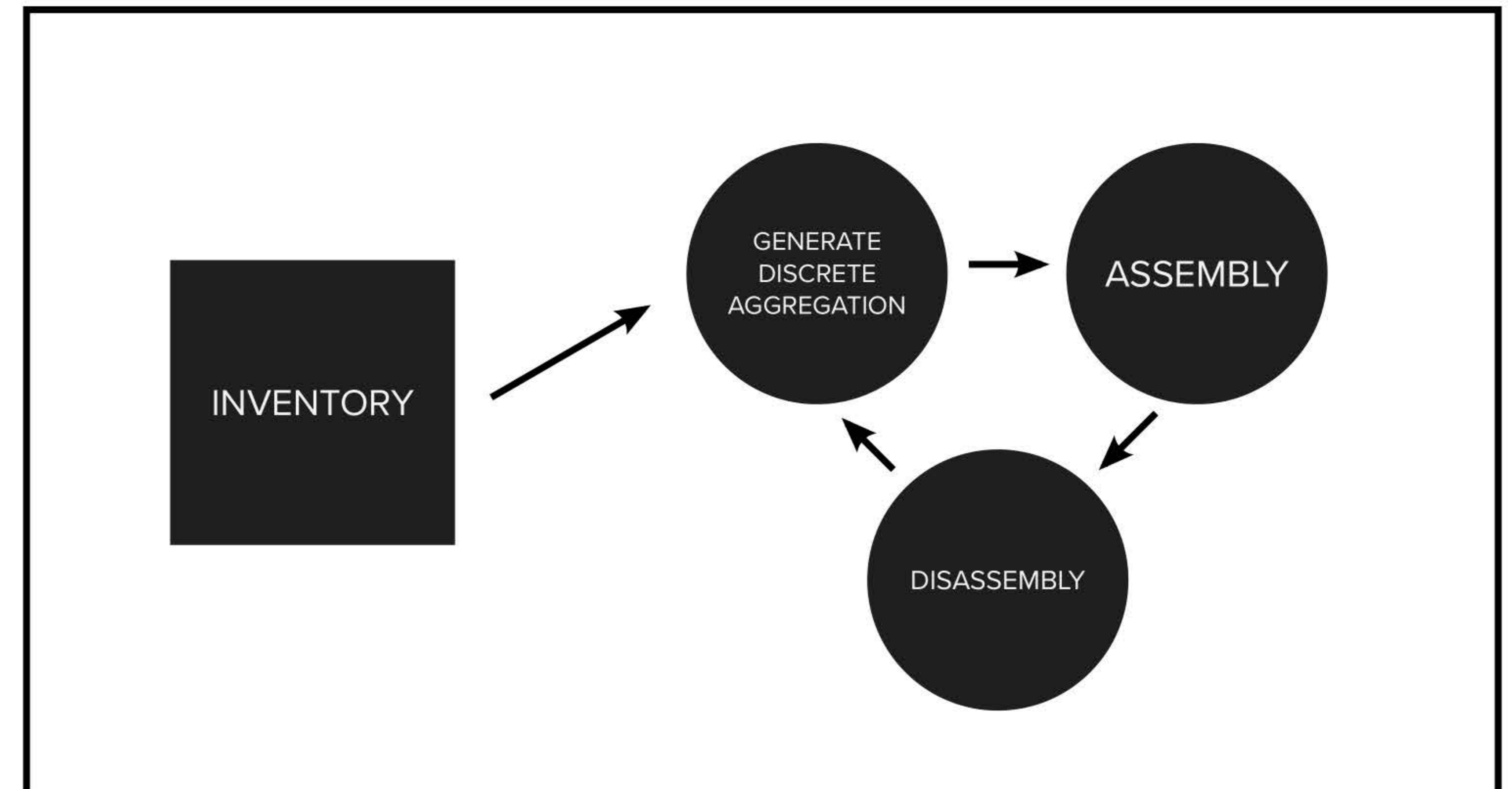


CIRCULAR ECONOMY

CIRCULARITY IN DESIGN



CIRCULARITY IN FABRICATION



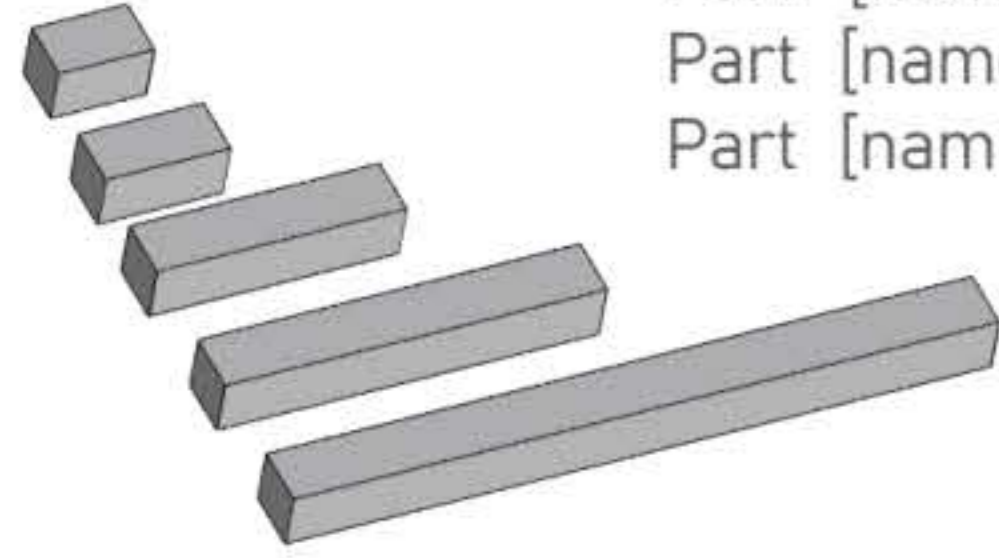
Inputs

Surface



The input surface can be used to generate the field constrain

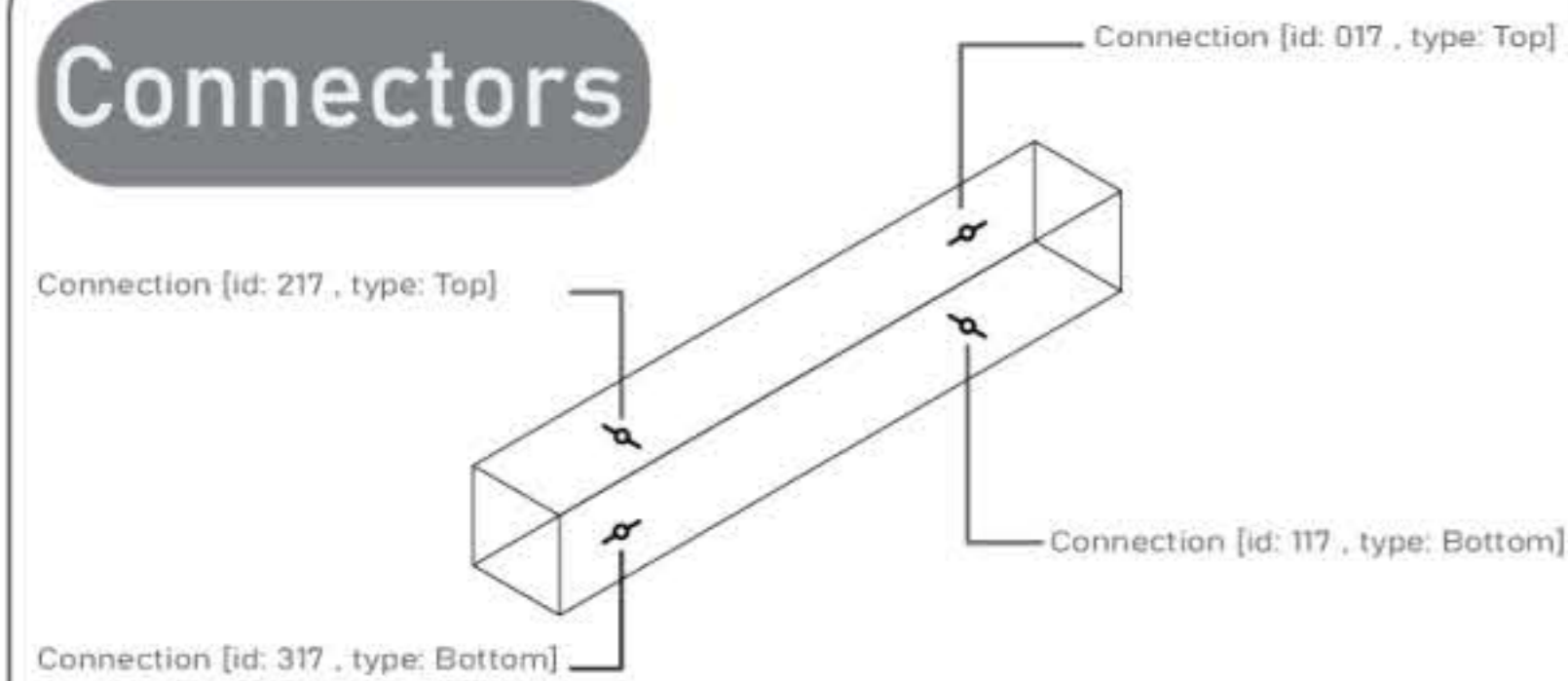
Parts



Part [name: 0, id: 48']
Part [name: 1, id: 26']
Part [name: 2, id: 17']
Part [name: 3, id: 8.5']
Part [name: 4, id: 6.5']

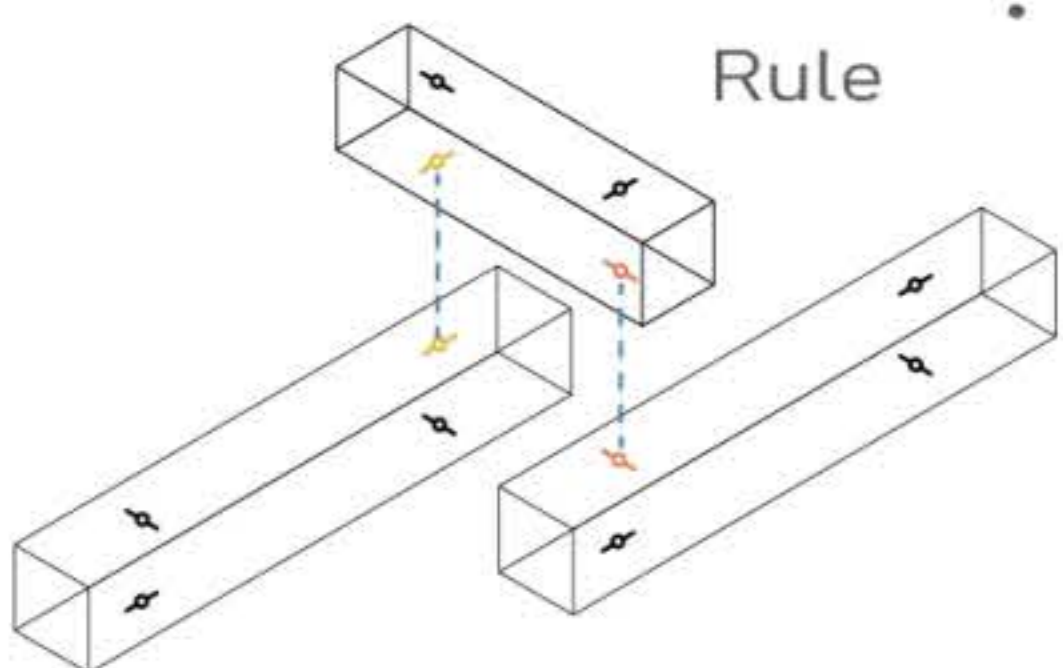
Parts are the wood blocks containing the geometrical properties and limit of usage

Connectors



Connectors are the pins which can demonstrate the position and orientation of

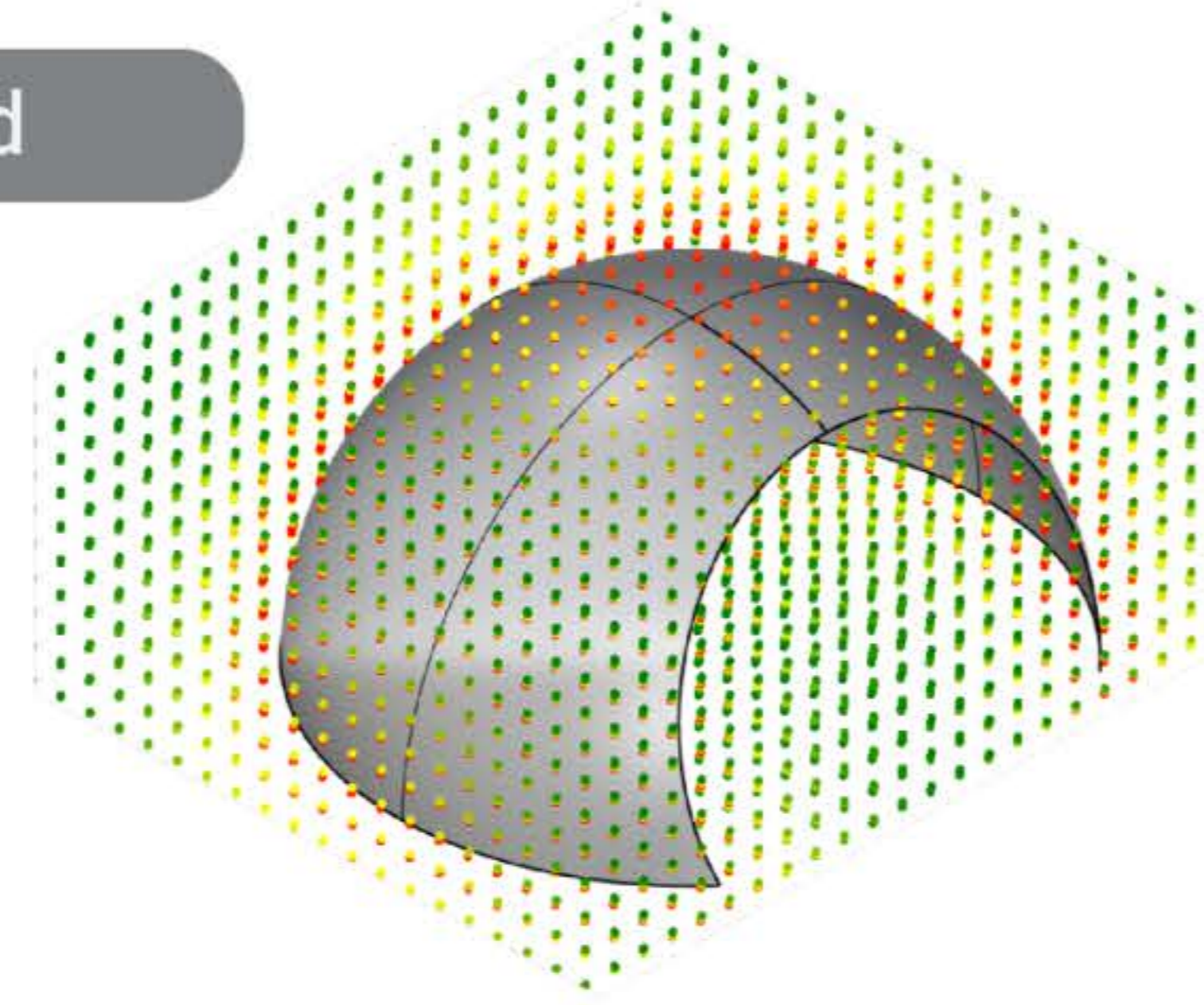
Rules



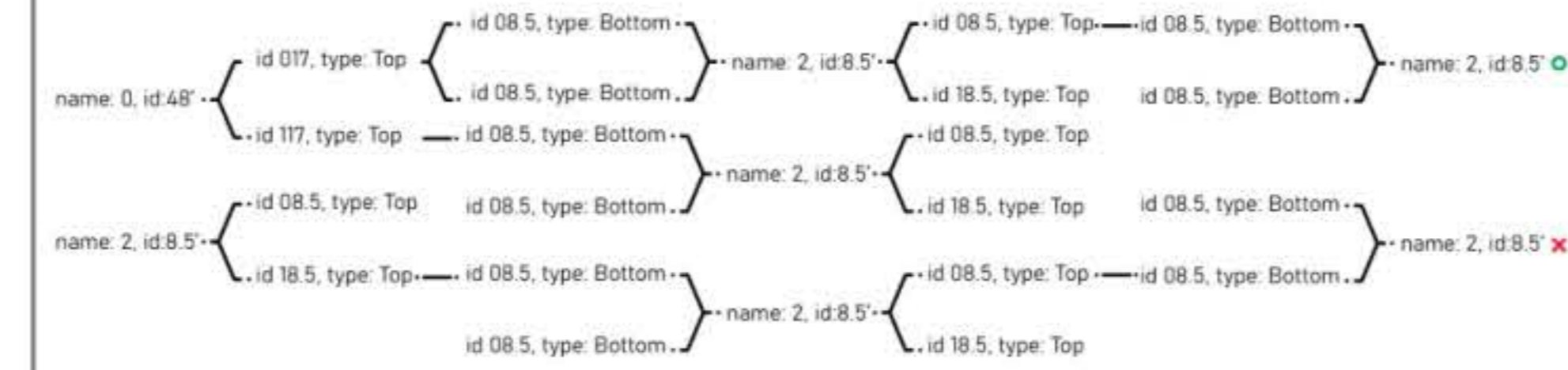
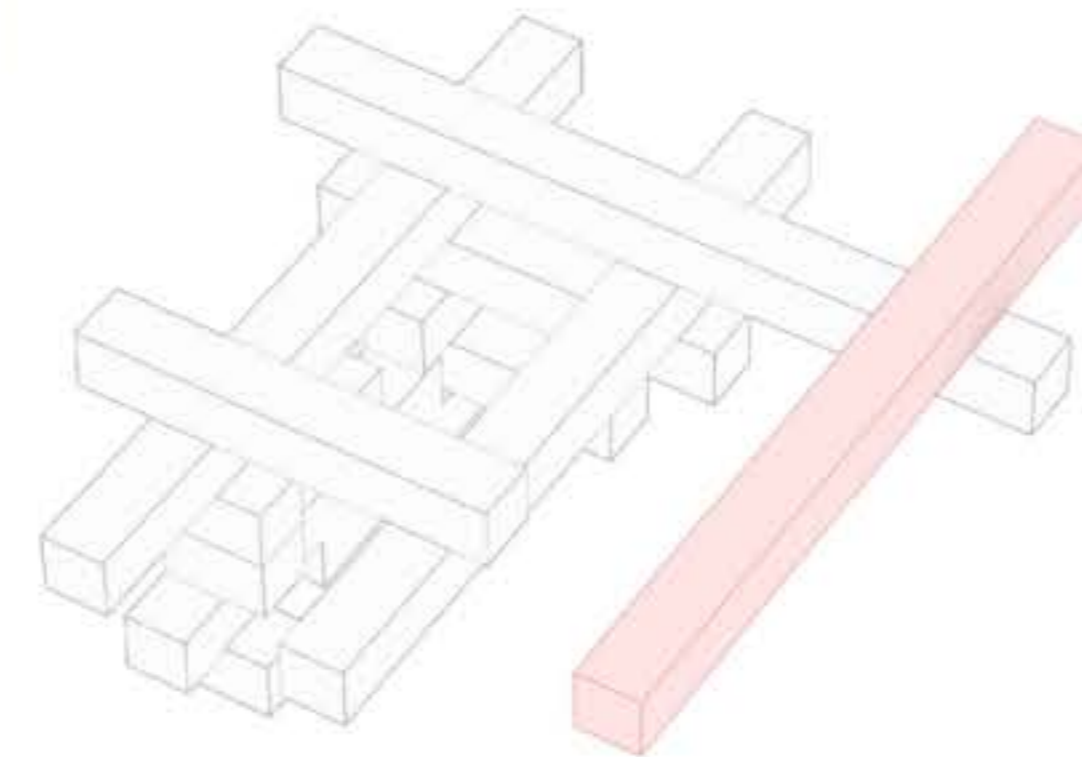
Rule [0|0_1|0]
Rule [0|0_1|1]
Rule [0|0_1|2]
Rule [0|0_1|3]
⋮
Rule [4|3_3|3]

Constraints

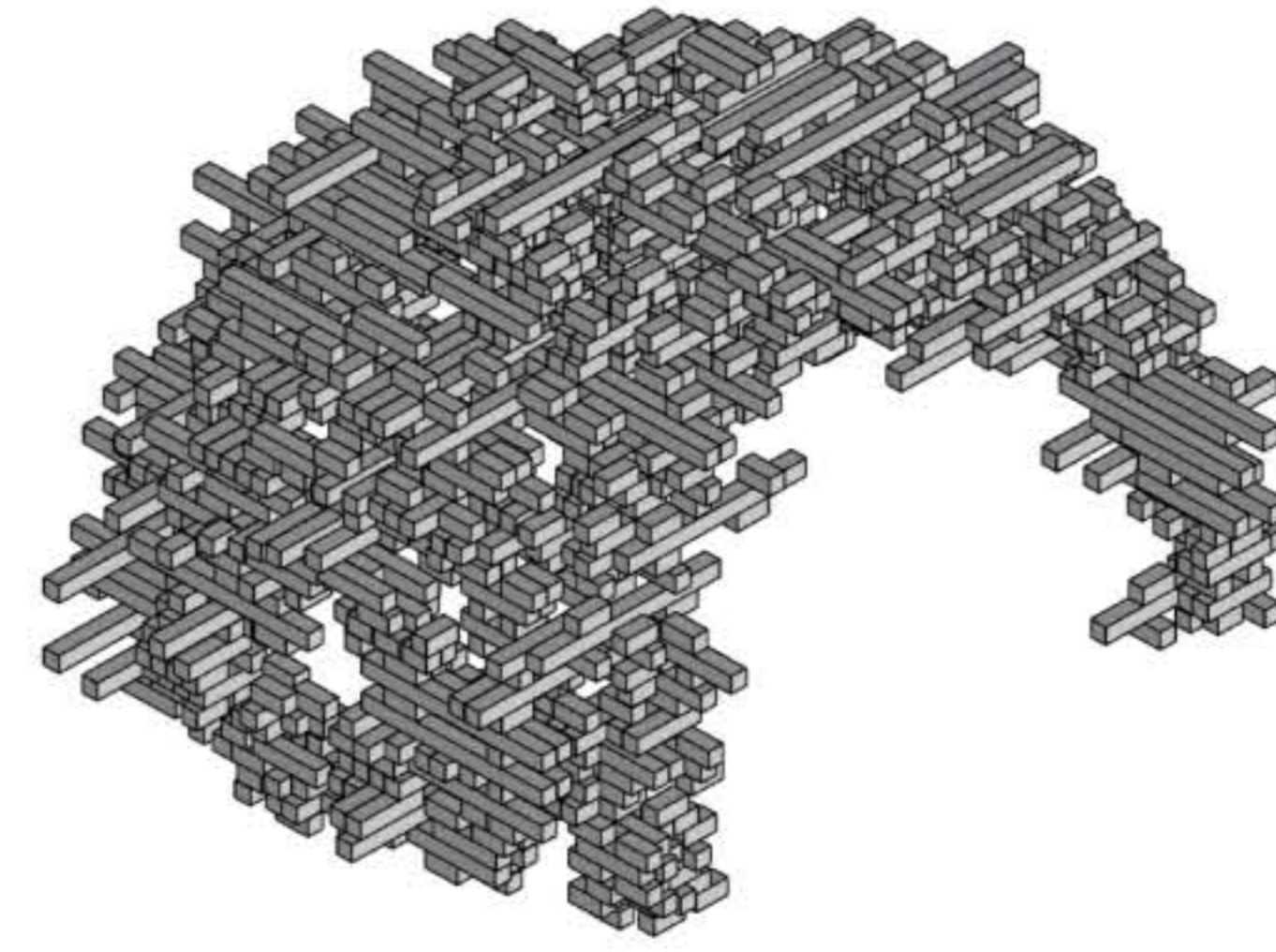
Field



Stability



Output



more outputs with different base geometries:

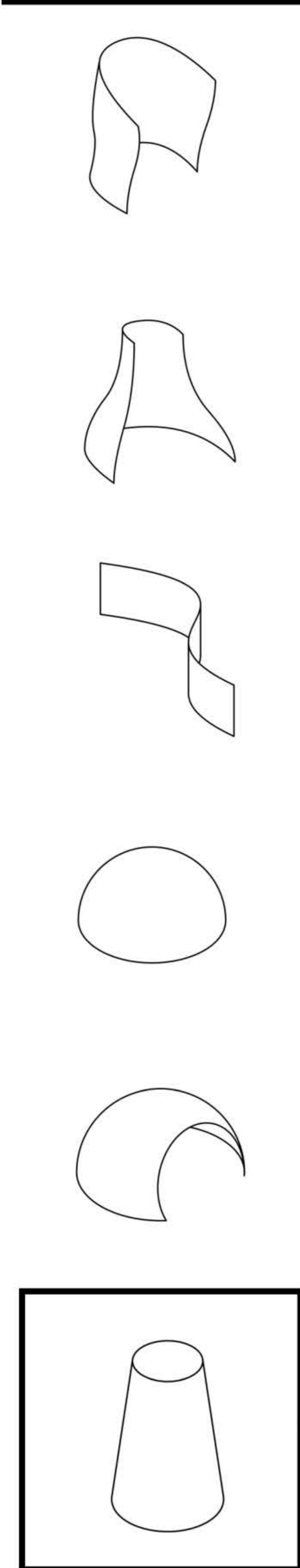


Grasshopper

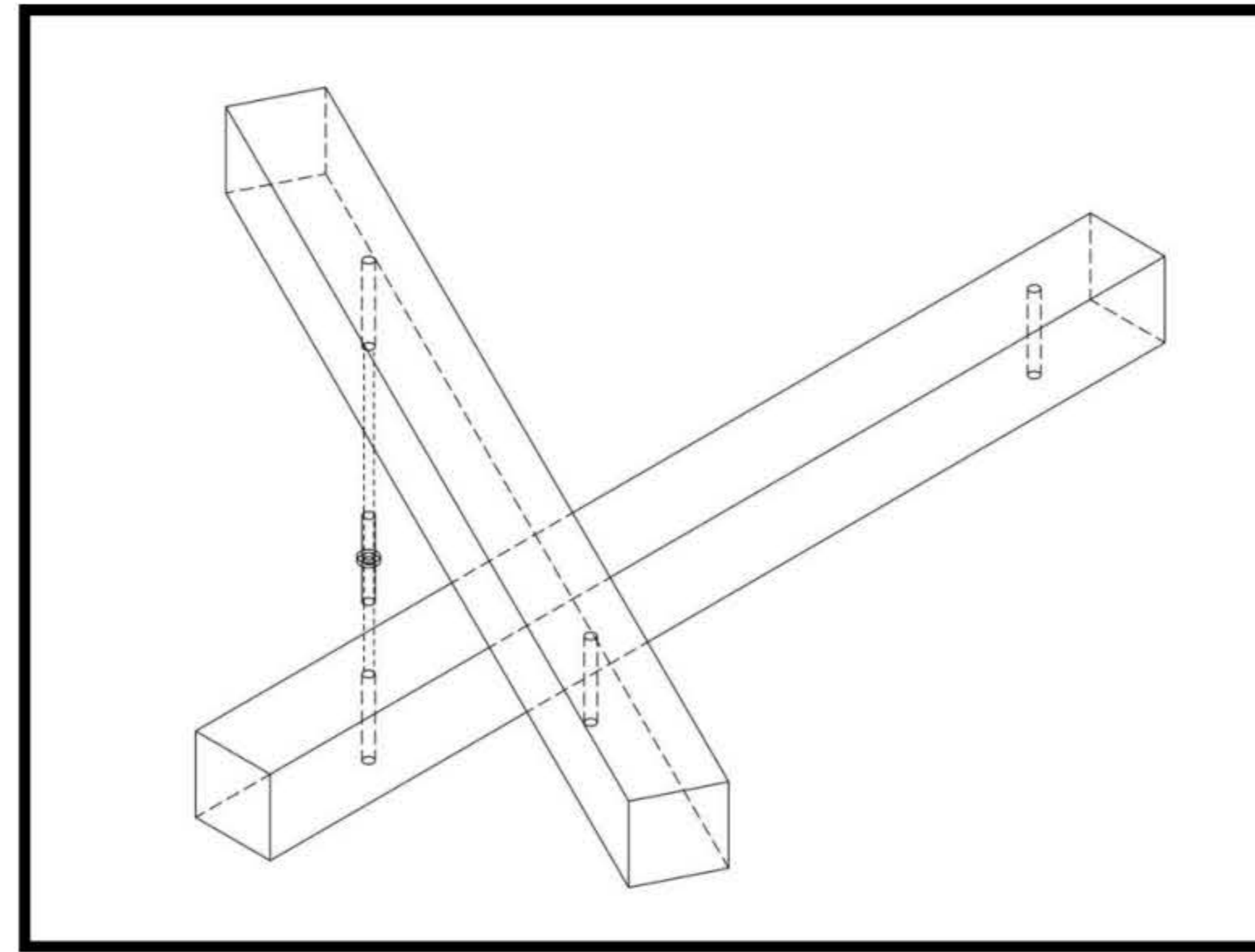


WASP

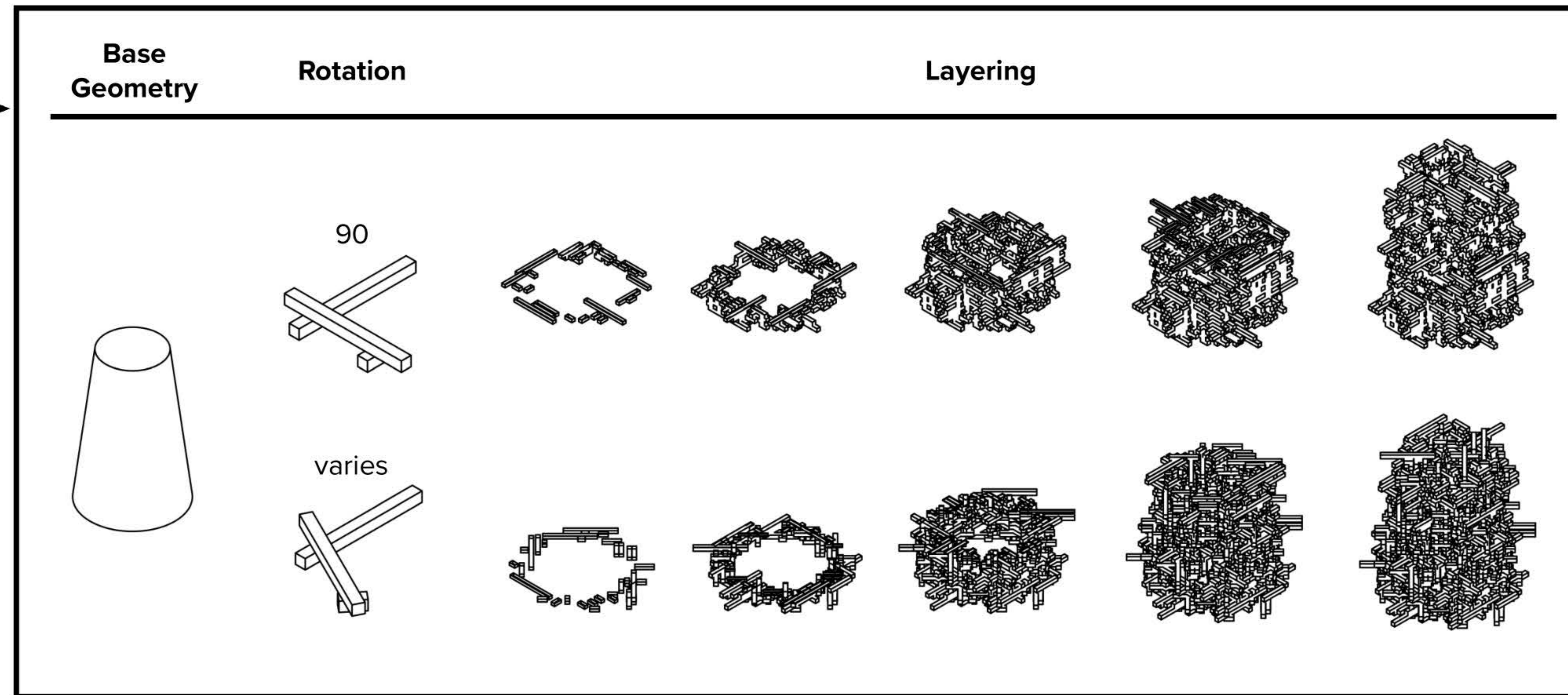
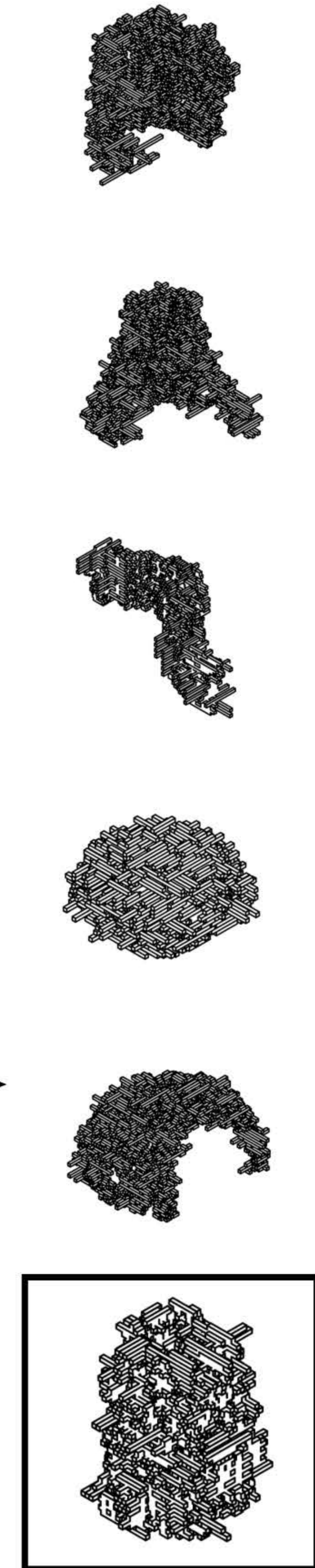
Base Geometry



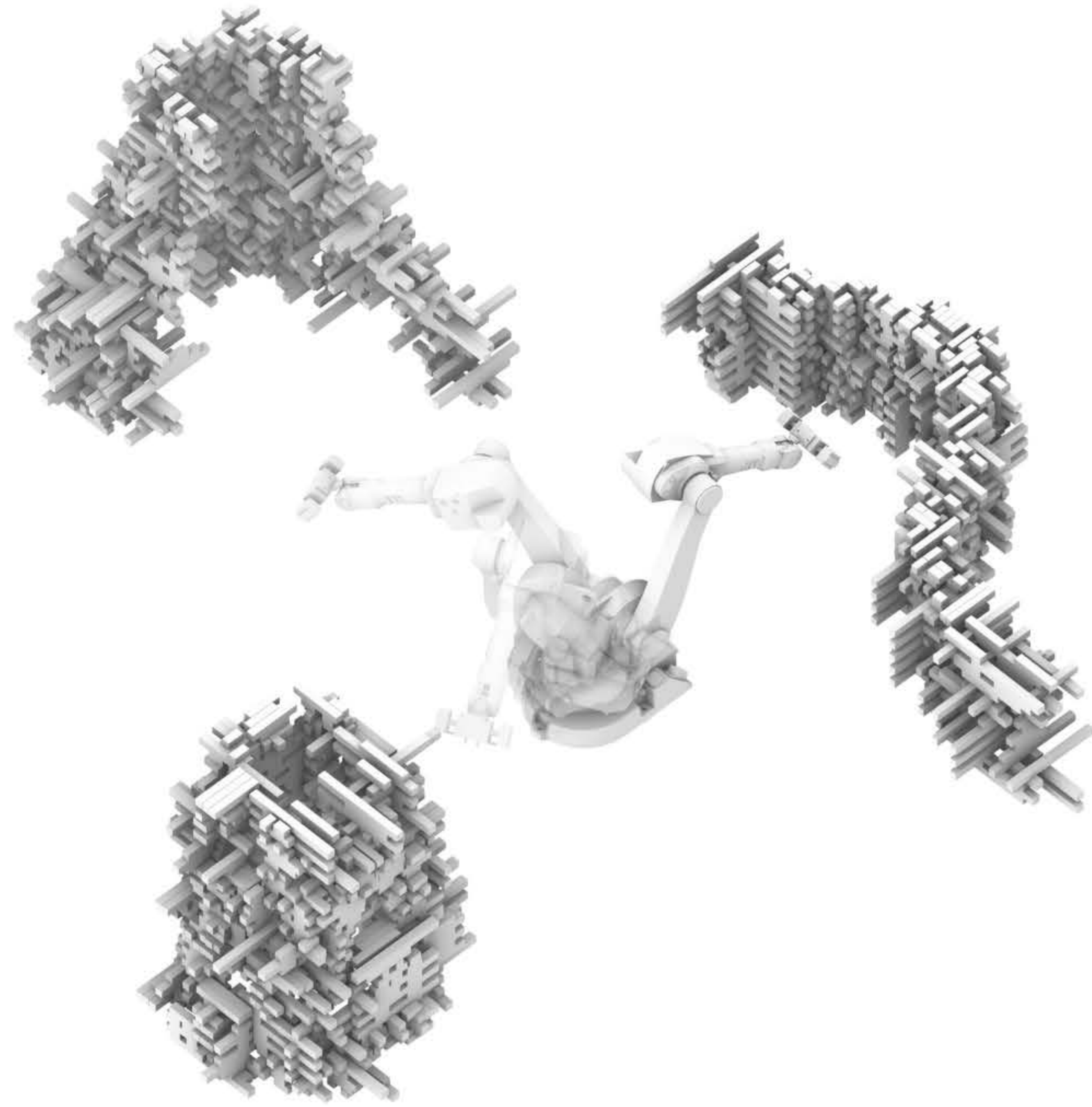
Lateral Force Resisting (Stainless Steel Pin)
+ The only modification is drilling two small holes on each part.



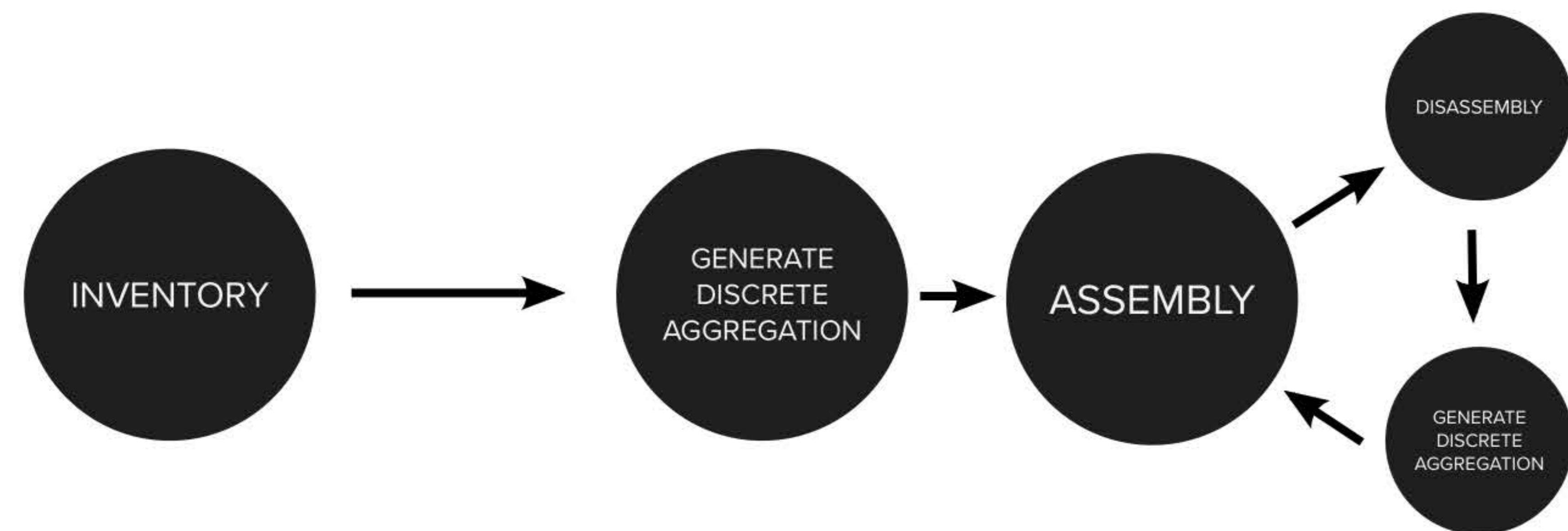
Generate Aggregation



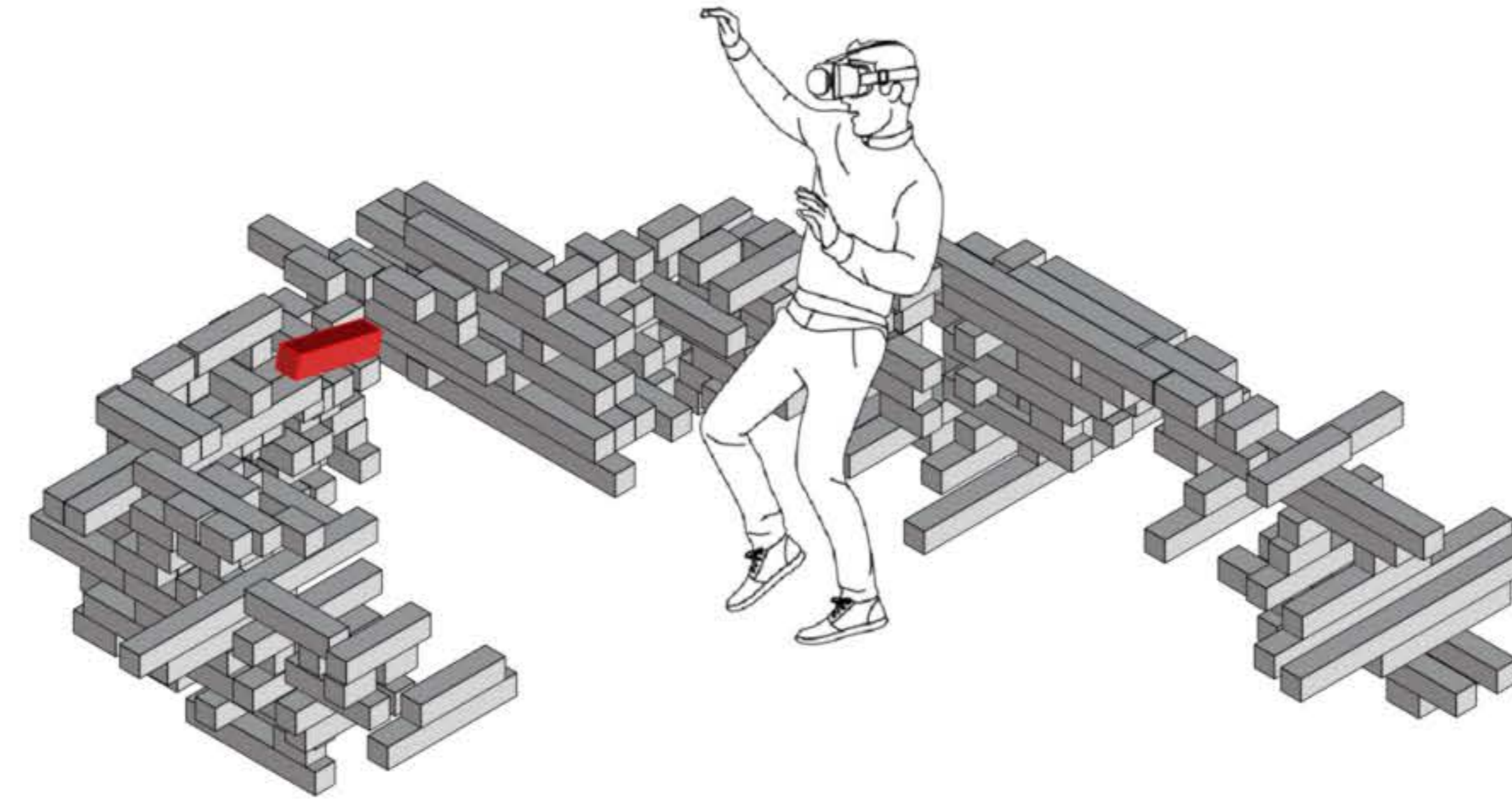
IDEA 1



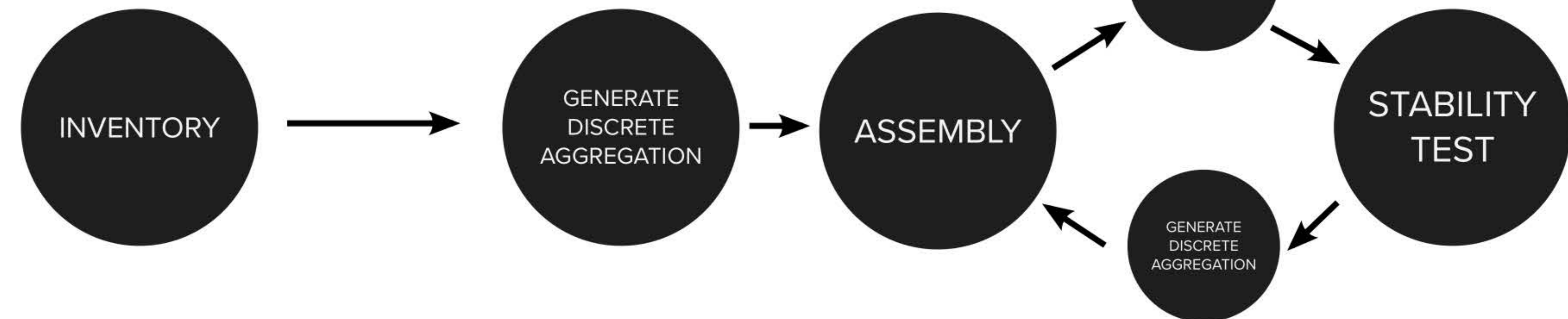
CONTINUOUS ROBOTIC FABRICATION
TOOLS: ROBOT ARM + TRACK



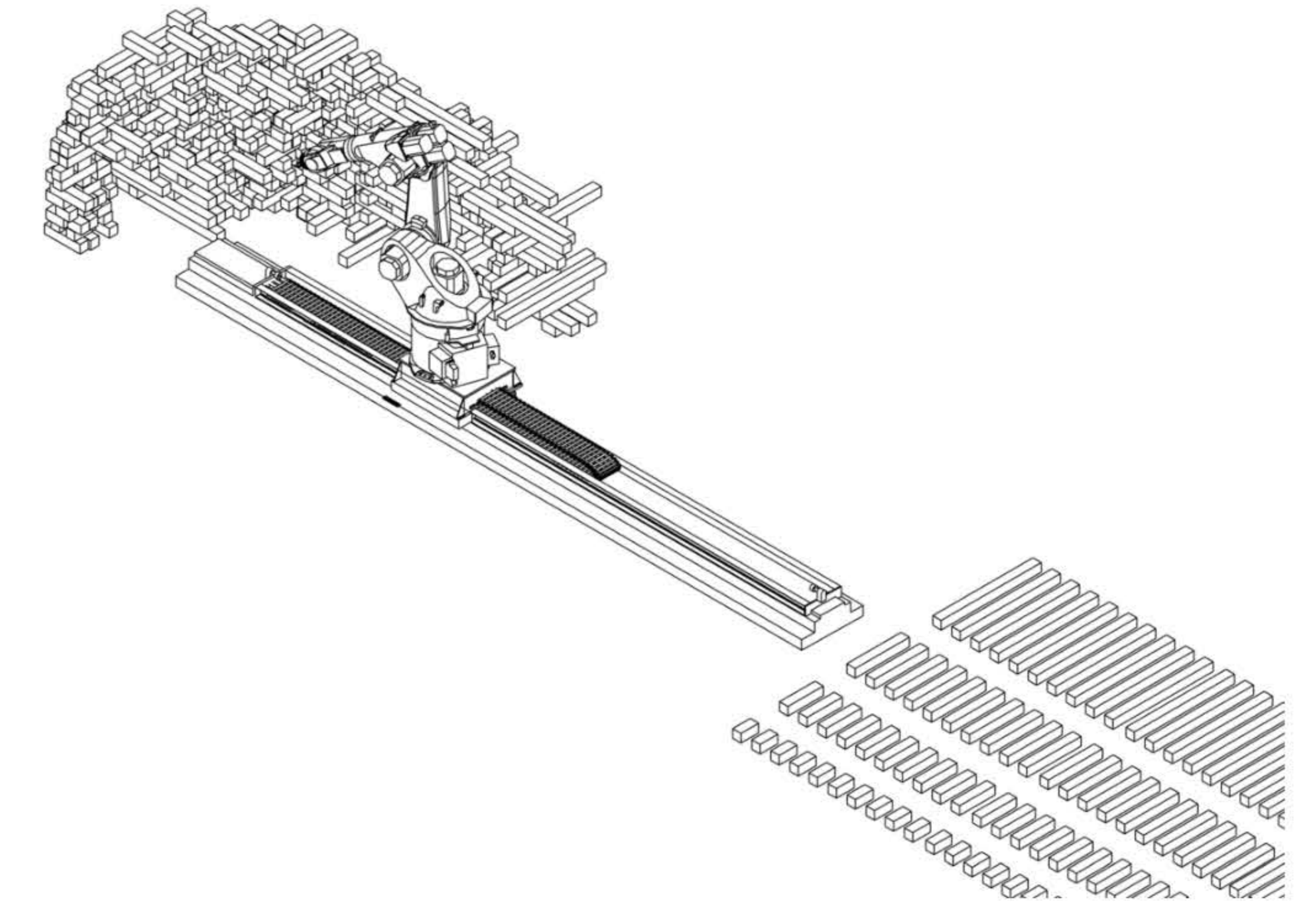
IDEA 2



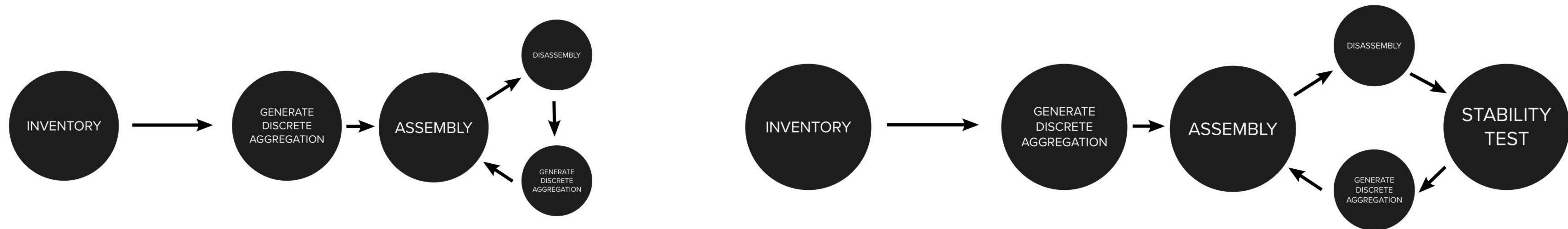
MANUAL ASSEMBLY + REAL-TIME STABILITY TESTING
TOOLS: MICROSOFT HOLOLENS 2 + UNITY (MRTK)



IDEA 3



ROBOTIC ASSEMBLY
TOOLS: ABB IRB 4600 (Payload: 20kg and Reach: 2.5m)
ABB IRBT 2005 - Medium Track Motion Platform



**Heaviest
Part
15 lbs**

&

**Farthest
Part
2.5 m**



**Payload
>7 kg**

**Reach
>2.5**



ABB

IRB 4600
Highly productive general purpose robot



IRB 4600 is a highly productive general purpose robot optimized for short cycle times where compact robots can help create high density cells. The IRB 4600 enables more compact manufacturing cells with increased production output and higher quality - and that means improved productivity.

Shortest cycle times
Thanks to its new compact and optimized design resulting in a low weight, the IRB 4600 can cut the cycle times of the industry benchmark by up to 20%. The maximum acceleration achievable is highest in its base, together with high maximum speeds. With the high acceleration it is possible to create small distances or follow the path. This benefits increased production capacity and higher productivity.

Wide work envelope
You can position the IRB 4600 in the most favorable way with respect to reach, cycle time and working equipment. Possible mounting with flow (flex) arms and a horizontal mounting in a very useful other way, are illustrating the best position for your application.

Compactness
The small footprint, the slim working base and the compact joints, the flow arm and the compact wrist allow you to place the robot in the most compact way. With the IRB 4600 you can create your production cell with reduced footprint by placing the robot closer to the work machines, which also increases your output and your productivity.

Best protection available
ABB is the most comprehensive protection program on the market and it is now even further enhanced with the IRB 4600. Priority Plus includes:

- IP 67 resistant joints, customized mounting flange and protection for twisted cables on the moving cables on the rear of the robot and extra protection plates over the floor cable connections on the base.
- Optimize and go sharp
To get the IRB 4600 ready for the toughest applications you have access to high performing end effector accessories, track motions, and the mouse and gear range.
- To simulate your production cell to find the optimal position for the robot and program it faster. Real-World is available on subscription together with PowerFlex for several applications.
- Learn more about how to use the IRB 4600 in your application and environment: search simulations of several applications at www.abb.com/robotics

Main applications

- Assembly
- Machine tending
- Machine handling
- Machine removal
- Chipping/Spinning
- Chipping
- Grinding
- Laser Cutting
- Laser Welding

Supported robot families

- IRB 3000
- IRB 3000
- IRB 4000

Benefits

- Compactness and modularity
- Integrated and protected components
- Prepared for different applications like: welding, Material Handling, Machine Tending
- A wide range of options for different configurations
- Unique platform for robot and transfer applications
- High reliability, low maintenance need, easy to repair welding and feeding

Outstanding speed and accuracy
ABB's unique QuickShut™ and TrueFlow are also critical to the IRB 4600's functionality. Together they guarantee optimal movement for the robot and the track with actual load. Both accuracy and speed are also optimized.

Adaptable to various environments
The IRB 2005 is available in two variants, standard environment and fully covered.


Each robot carriage has the option of being equipped with an empty external cable chain for all general application cables. Robot cables range from 200mm to 1000mm and can be selected as an robot orientation.

PDF IRB4600_ROB0109EN_20220505_digital.pdf

&

ABB

IRBT 2005
Medium Track Motion Platform



The only track motion platform on the market to guarantee high speed and precision accuracy, the IRBT 2005 from ABB offers greater flexibility and up to 50% shorter cycle times.

Modular platform design
ABB's Medium Track Motion Platform design is smart and compact with a symmetrical profile. Maximum integration ensures the protection of components in a small footprint.

The IRBT 2005 consists of a standard 1 meter long module that allows for the addition of numerous track and wear lengths for robots and transfer applications. The track's modularity allows for gradual evolution during its entire life span.

Adaptable to various environments
The IRBT 2005 is available in two variants, standard environment and fully covered.

Each robot carriage has the option of being equipped with an empty external cable chain for all general application cables. Robot cables range from 200mm to 1000mm and can be selected as an robot orientation.

Outstanding speed and accuracy
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Supported robot families

- IRB 3000
- IRB 3000
- IRB 4000

Benefits

- Fast accuracy best in class
- Compactness and modularity
- Integrated and protected components
- Prepared for different applications like: welding, Material Handling, Machine Tending
- A wide range of options for different configurations
- Unique platform for robot and transfer applications
- High reliability, low maintenance need, easy to repair welding and feeding

PDF ROB0329EN_A_irbt2005_datasheet (1).pdf

We propose to make it in CCA/Digital Craft Lab (San Francisco).



Potential Collaborator:



AUTODESK

**Technology Center
(Pier 9) San Francisco**



AUTODESK

**Technology Center
Boston**

1. Utilization of the stock

- Does the project utilize the stocks close to its original state, or does it require significant modifications to the stock?

-The only modification is drilling two small holes on each part.

2. Consideration of secondary impacts

- Can the structure have a second life? Can it be disassembled, reassembled into different configurations?
- Will it require secondary procedures- 3D printed, machined joints, off-the-shelf products? If so, is the impact of these secondary procedures considered in the proposal?
- Are the machine times and the resulting energy consumption considered?

-Sure!

-No! The only possible option is Stainless Steel Pin for lateral force resisting.

-Yes!

3. Involvement of Technology

- How does technology affect and improve the workflow of design and fabrication?
- Level of involvement of technology (including but not limited to computational design, structural optimization, mixed reality, digital/robotic fabrication, AI assisted workflows) within the various phases of the project. For example, does the strategy require human-robot collaboration in the production and/or installation phase? Or can it utilize mixed reality and/or laser projection in the production and installation phase?

-Using Grasshopper+WASP to make a design solution for discrete aggregations.

-We have 3 ideas for fabrication with using robot arm and Hololens 2. We also use Unity (MRTK) for real-time atability monitoring in fabrication process.

4. Compelling narrative

- Does the project have a narrative, and a function that goes beyond structural and material optimization?
- Does it have a compelling visual language?

-Yes. We focus on circular economy and reusing material without any change and generate millions of iterations by changing the base geometry.

5. Fabrication Strategy & Level of Support

- How will the project be made? What facilities will be used to fabricate the project?
- Does the academic research group have the in-house capabilities to execute the project, or will they require Eventscape's support? If so, what level of support will they require?

-We are able to make it in Digital Craft Lab at CCA in collaboration with Eventscape.

The other option is collaborating with Autodesk in San Francisco or Boston Technology Centers.

