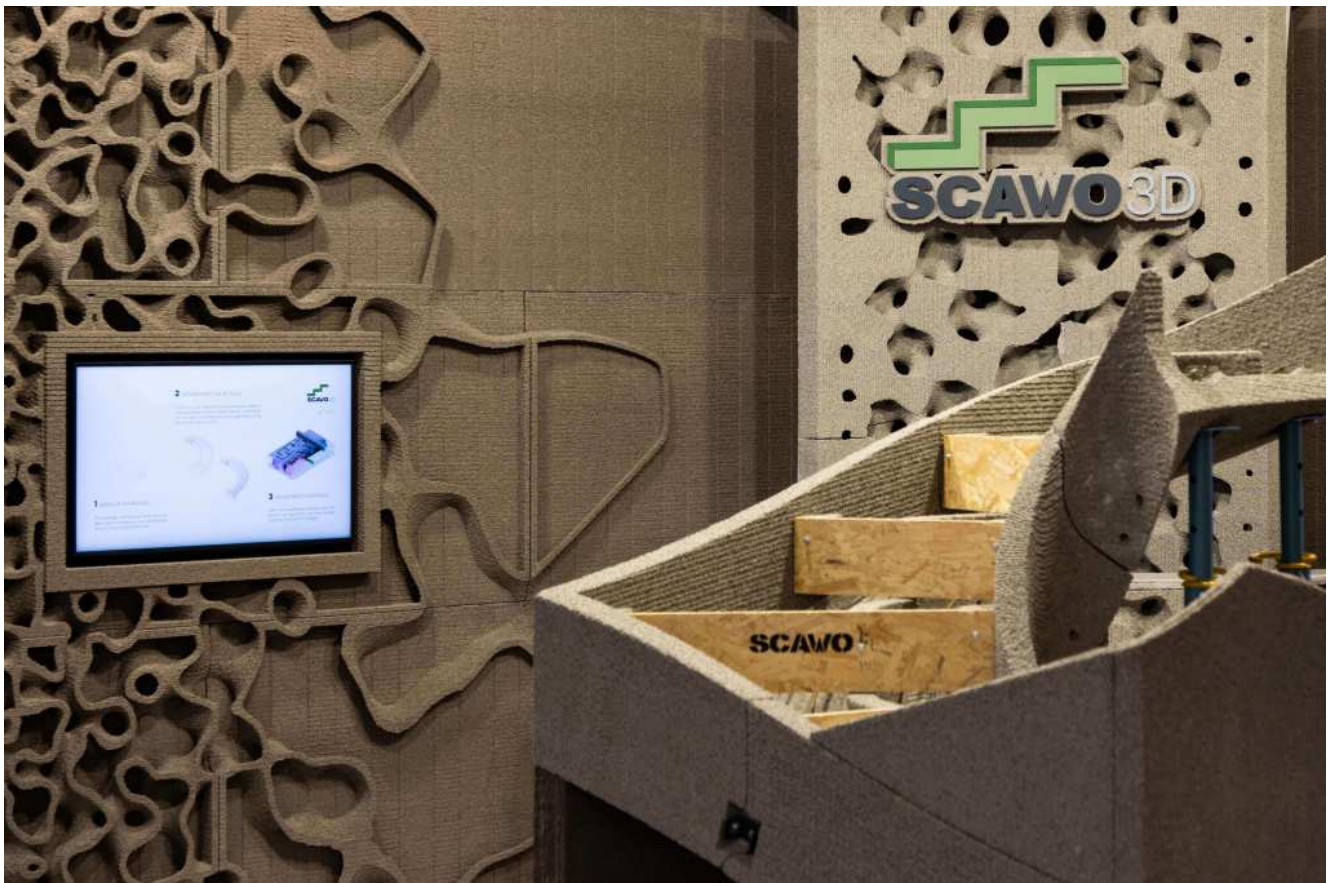


Revolutionizing 3D Concrete Printing with Selective Paste Intrusion and Spherene

At BAU 2025 in Munich, [Scawo3D and Skeno](#) set out to showcase a groundbreaking advancement in 3D concrete printing: Selective Paste Intrusion (SPI). This method, pioneered by [Scawo3D](#), introduces a novel inkjet printhead capable of precisely depositing cement paste within a bed of loose aggregate. Paired with computational design tools like [Spherene](#) for Rhino/Grasshopper, SPI is redefining what's possible in concrete architecture—allowing for intricate geometries and optimized structural performance that was previously unattainable.



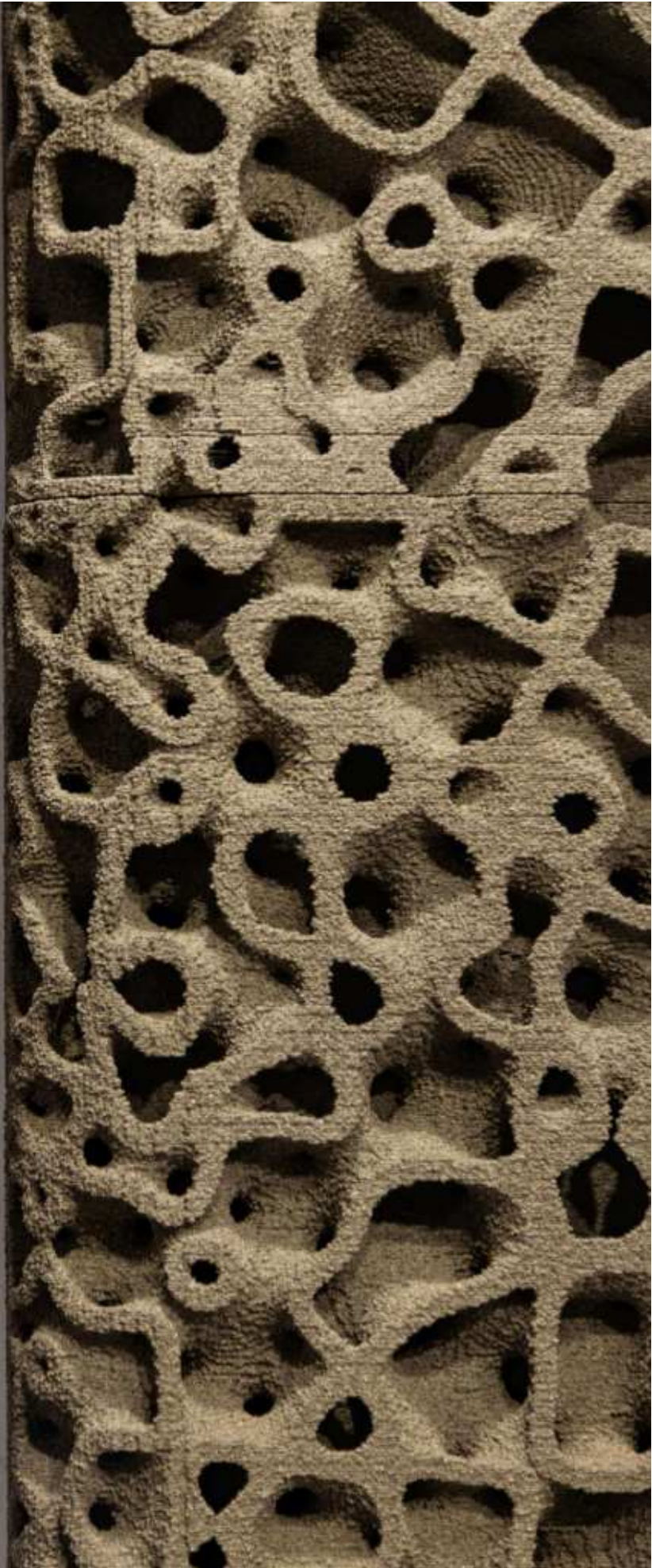
PUSHING THE BOUNDARIES OF

ARCHITECTURAL FABRICATION

The exhibition booth at BAU 2025 was designed to be both a demonstration and a research object, testing the real-world applications of SPI. Every component was 3D printed, reinforcing the commitment to fully leveraging additive manufacturing for architectural elements. More than a display, the booth explored how SPI can be applied to load-bearing structures, offering new possibilities for construction with minimal material waste.

[Spherene](#), integrated into the booth's design via [Rhino](#) and [Grasshopper](#), played a key role in optimizing structural and thermal performance. The resulting components were functional and visually striking, showcasing a refined balance between aesthetic expression and engineering efficiency.

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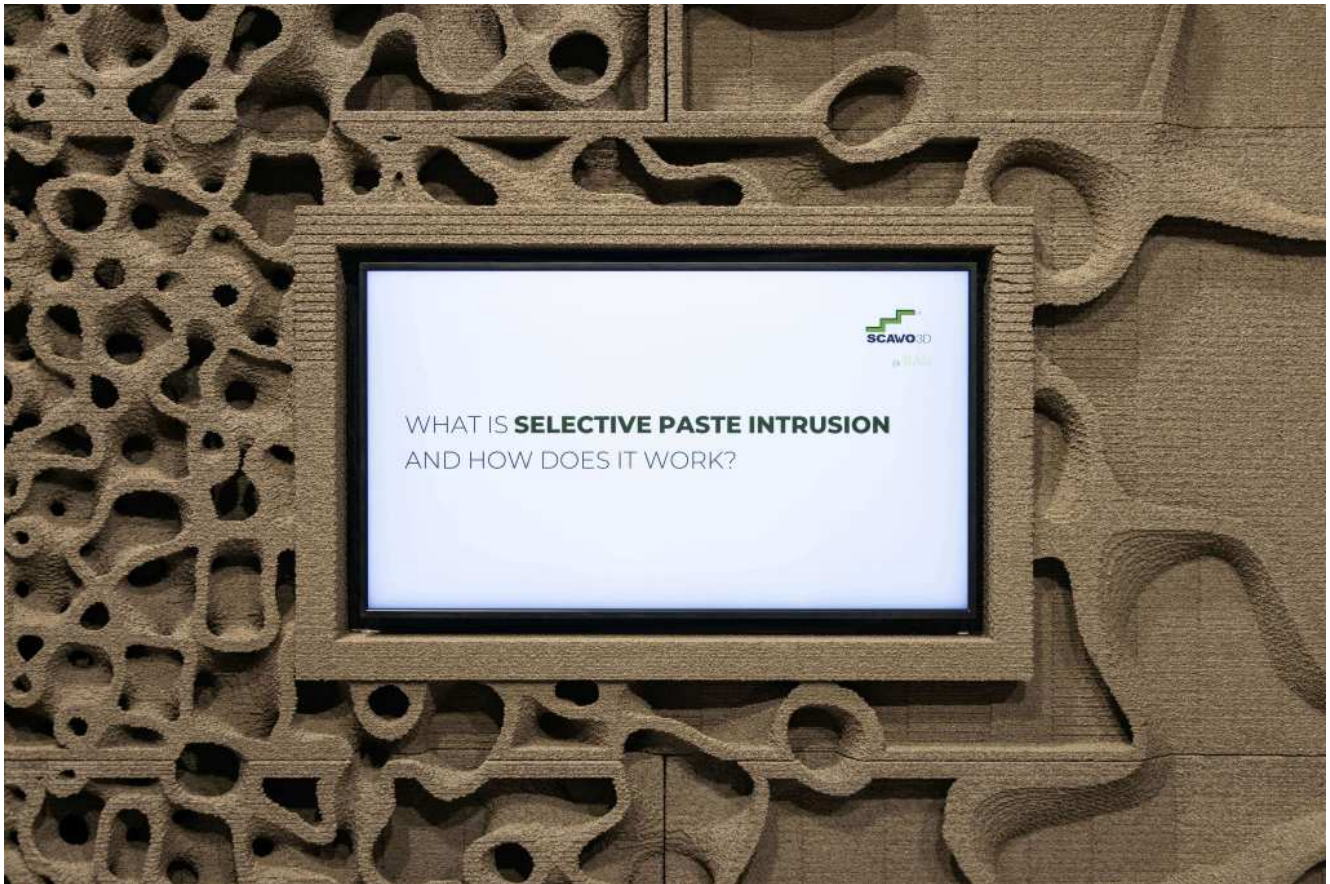


COMPUTATIONAL DESIGN & MODERN ASSEMBLY

Designed within a compact 25m² corner space, the booth was structured to balance functionality and impact:

- 3m-high back walls featuring integrated Spherene structures, divided into six modules for easier handling. Each module weighed between 150 and 320 kg.
- A 3m-high central wall bearing the Scawo3D logo, segmented into two parts for transport efficiency.
- A modular counter divided into two sections, serving as a discussion and information hub.
- A 3D-printed staircase, developed in collaboration with Skeno and Timo Harboe, demonstrating SPI's ability to produce complex, load-bearing structures.

To complement the physical exhibit, two digital displays provided visitors with additional insights into SPI's capabilities without overwhelming the space with excessive physical elements.



FROM DIGITAL DESIGN TO CONCRETE REALITY

The SPI Process: A New Approach to 3D Concrete Printing

The SPI method operates on a large-scale particle bed (4 x 2.5 x 1.5 meters), using a layer-by-layer technique to achieve precision and complexity:

1. A loose aggregate bed is prepared with materials such as crushed quartz sand or lightweight expanded clay.
2. Scavo3D's printhead injects cement paste into the dry aggregate with high precision, forming the structural components.
3. The next aggregate layer is applied, and the process repeats in 3mm increments until the entire structure is built.

For the BAU 2025 booth, this process was completed in just two sessions:

- Back walls: Printed in a single 6-hour session using

lightweight expanded clay, totaling 1.9 tons.

- Remaining components: Printed in 4 hours using quartz sand aggregate.

This rapid fabrication method not only shortens production time but also minimizes material waste, making it an efficient alternative to traditional concrete construction.



COMPUTATIONAL DESIGN WITH RHINO, GRASSHOPPER, & SPHERE

The booth's design relied on computational tools to streamline the development of its intricate geometries. Rhino and Grasshopper provided the flexibility to refine the booth's layout, while Spherene enabled precise control over density, thickness, and structural performance.

To accelerate the design iteration process, the team implemented a parametric workflow:

- Spherene envelopes (env, dfenv) allowed for quick exploration of different structural configurations.
- Dynamic parameter adjustments controlled material distribution

and performance.

- Customizable boundary attributes ensured smooth transitions between components.

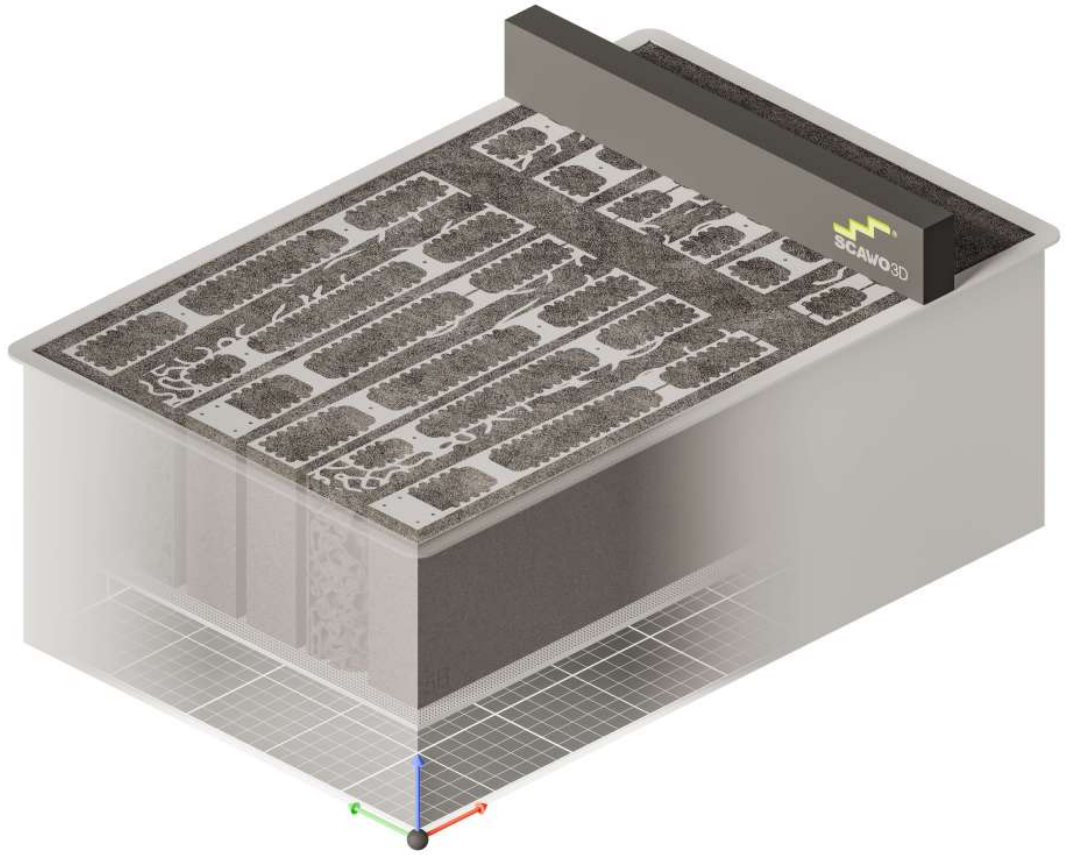
This approach enabled the team to iterate rapidly, optimizing the balance between form and function without compromising manufacturability.



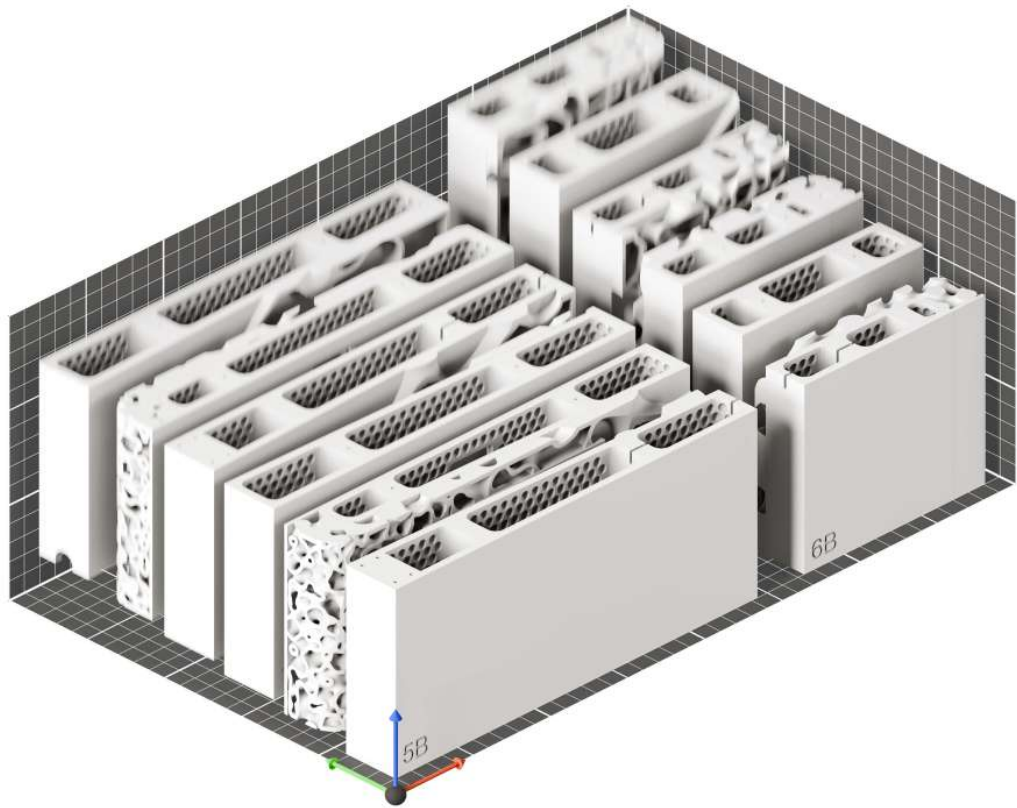
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OVERCOMING CHALLENGES WITH COMPUTATIONAL PRECISION

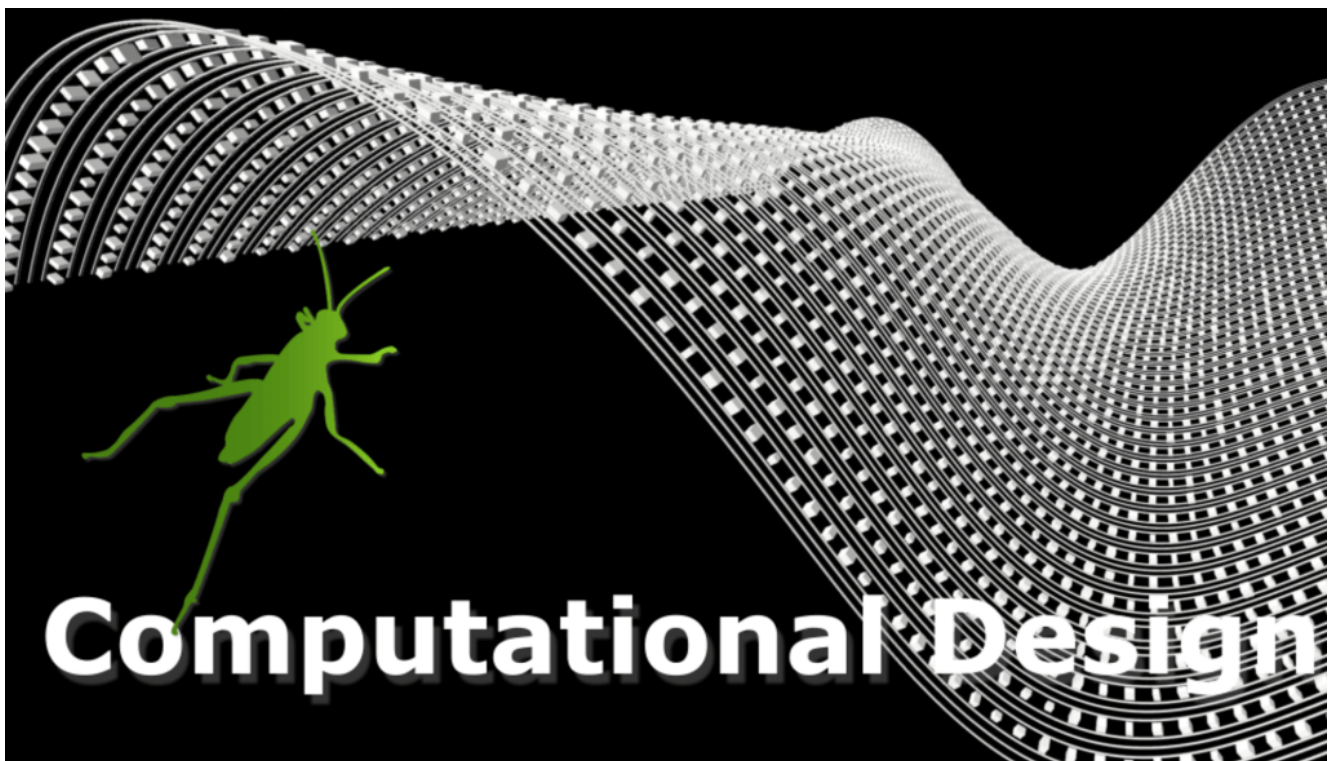
Solution: A Flexible Grasshopper Workflow

One of the biggest challenges was efficiently iterating through multiple design variations, ensuring each version maintained structural integrity while remaining feasible for SPI production.

By utilizing Grasshopper's parametric capabilities, the team was able to adjust design parameters in real-time. This allowed for:

- Quick exploration of different Spherene structures.
- Rapid testing of density and material distribution settings.
- Adaptability to fabrication constraints while preserving aesthetic goals.

This computational approach streamlined decision-making and ensured that the final booth met both visual and structural requirements.



[See Also](#)

[COMPUTATIONAL DESIGN WITH GRASSHOPPER](#)

FINAL OUTCOME: A GLIMPSE INTO THE

FUTURE OF CONCRETE ARCHITECTURE

The BAU 2025 booth successfully demonstrated how SPI, coupled with computational design tools, can redefine architectural possibilities. With the ability to fabricate highly detailed, freeform structures at an architectural scale, this collaboration between Scawo3D, Skeno, and Spherene represents a significant leap forward in digital fabrication.

As the industry moves towards more sustainable and efficient construction methods, projects like this highlight the potential of additive manufacturing to transform how we build. SPI is not just an alternative to traditional concrete—it's a vision of the future, where complex geometries and optimized structures become standard practice rather than exceptions.



CREDITS

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[Skeno](#) – Design

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Grasshopper, and Autodesk Fusion

Philip Schneider (Scawo3D) & Daniel Bachmann (Sphere Ltd.) –

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