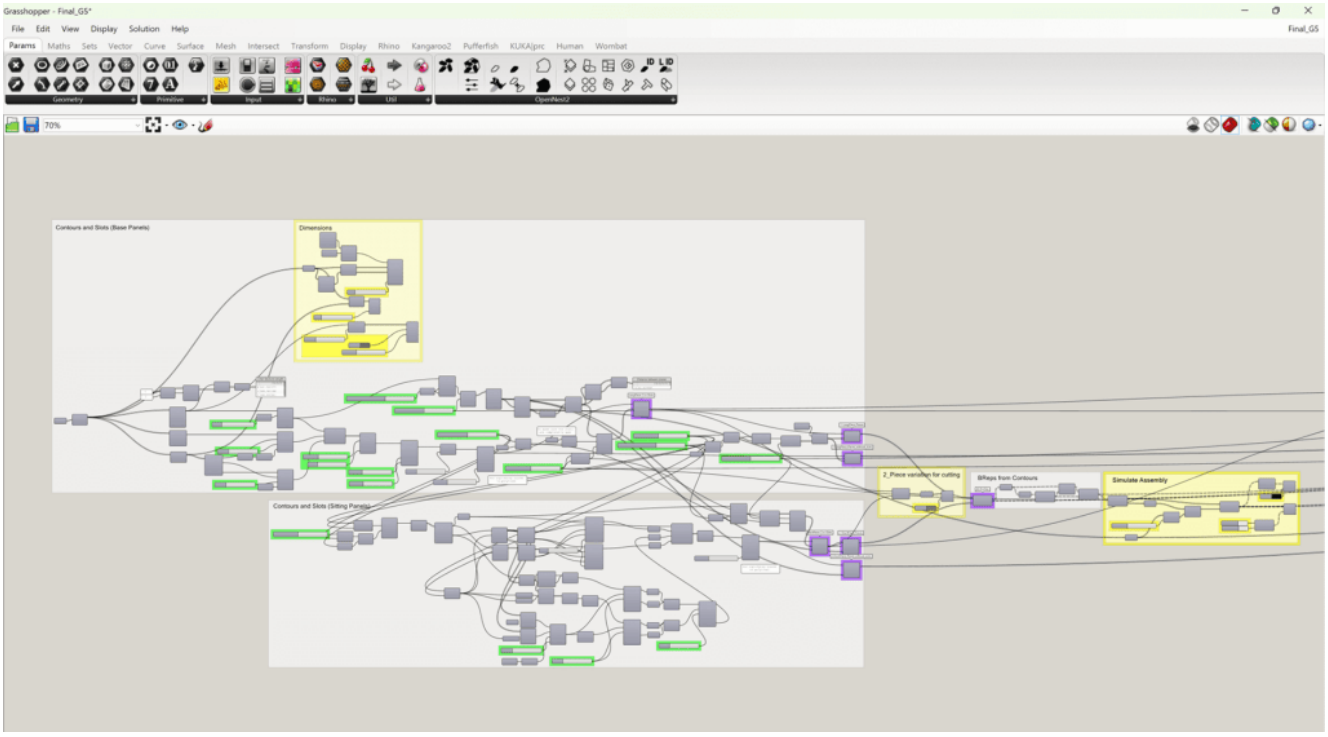
Waffle-Structured Chair: Exploring Robotic Manufacturing in Design Education

As part of the DIA Master's Program at Hochschule Anhalt, a group of students explored the potential of computational design and robotic manufacturing by creating a full-scale, waffle-structured ergonomic chair. The project was developed in the elective course *Robotic Manufacturing*, led by Prof. Juanfra García Guillén, and later exhibited during Campus Fest 2025 in Dessau.



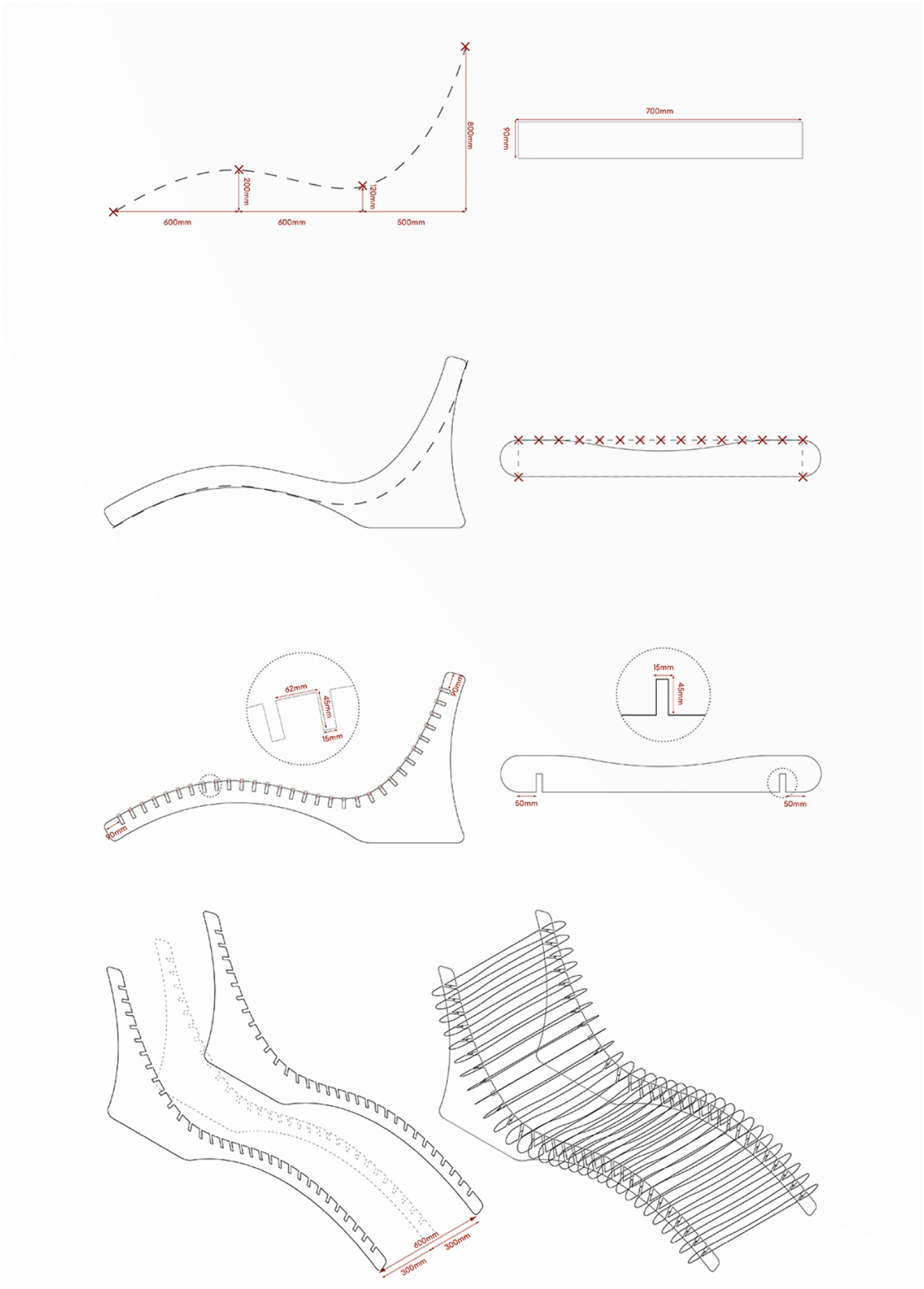
The design process, the preparation of 2D files for laser cutting, and the preparation of the module file for robotic manufacturing were carried out in Grasshopper.

MODULAR & ERGONOMIC DESIGN

The chair was conceived as a study in efficiency, modularity, and human comfort. The design is composed of only two unique panel types:

- 31 identical sitting panels forming the seating area
- 2 identical base panels supporting the structure

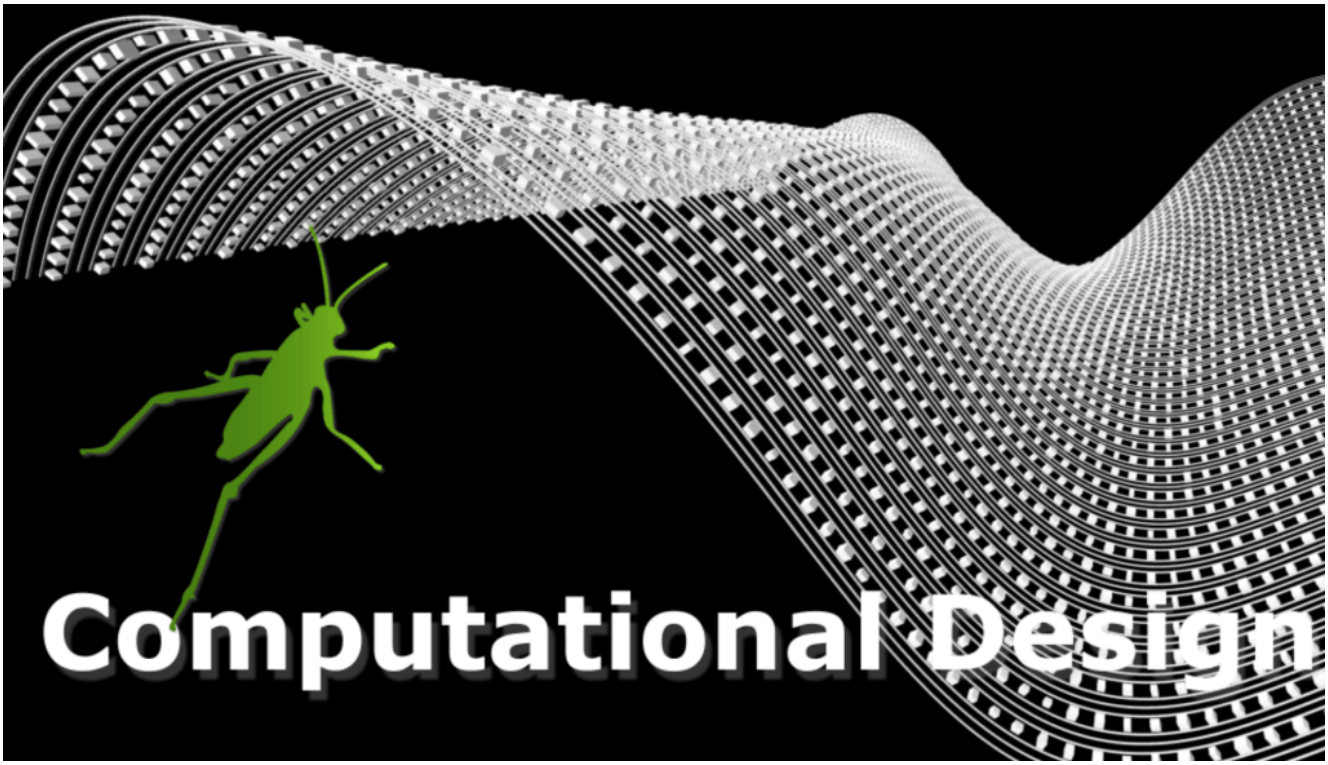
This modular approach not only minimized material waste but also simplified fabrication and assembly, eliminating the need for labeling or complex joinery. To ensure ergonomic quality, the designer, Atefeh S. Janfada, referenced her own body dimensions as an initial guide, while adjusting the geometry to accommodate a broader range of body types.



The Waffle-Structured Chair is a full-scale ergonomic chair.

COMPUTATIONAL WORKFLOW IN GRASSHOPPER

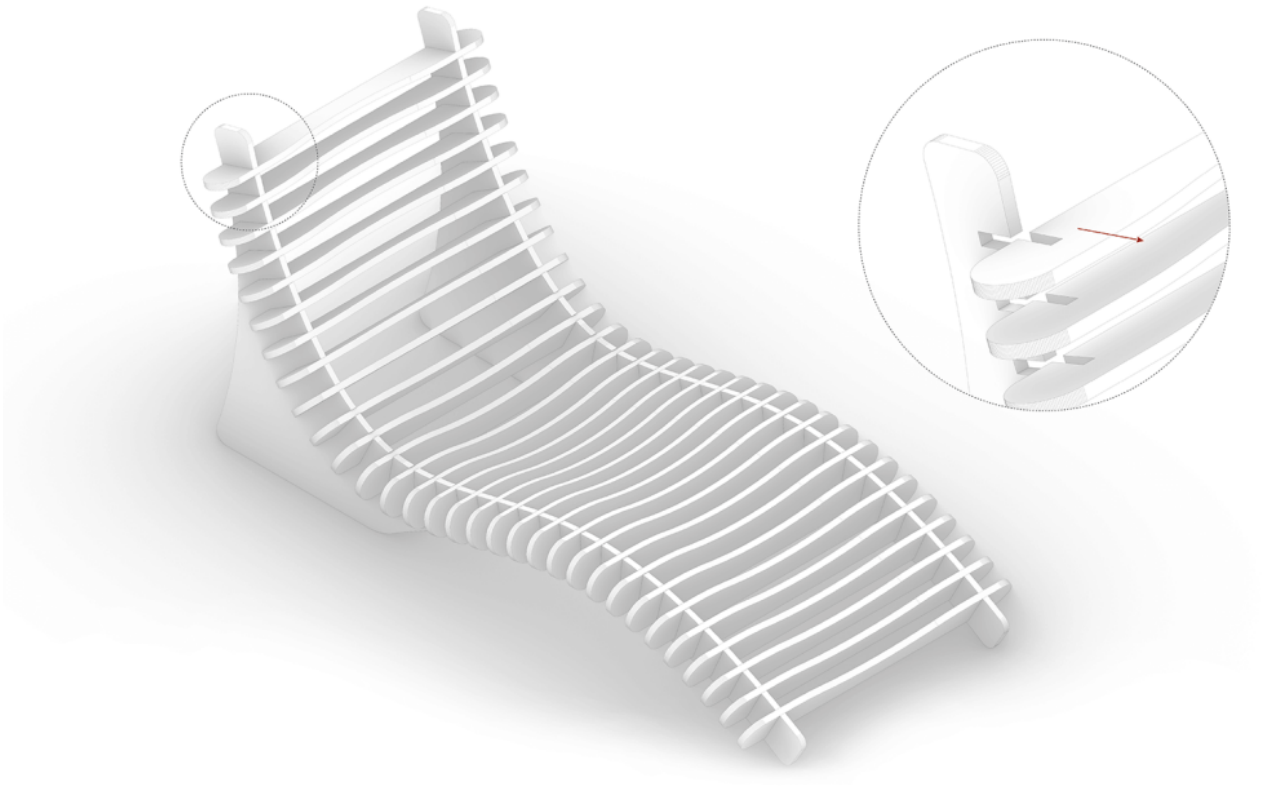
The design process was carried out entirely in Grasshopper, from early ergonomics studies to fabrication preparation. Steps included defining key curves, generating seating and base geometries, introducing slot intersections, and orienting the panels for precise alignment.



See Also

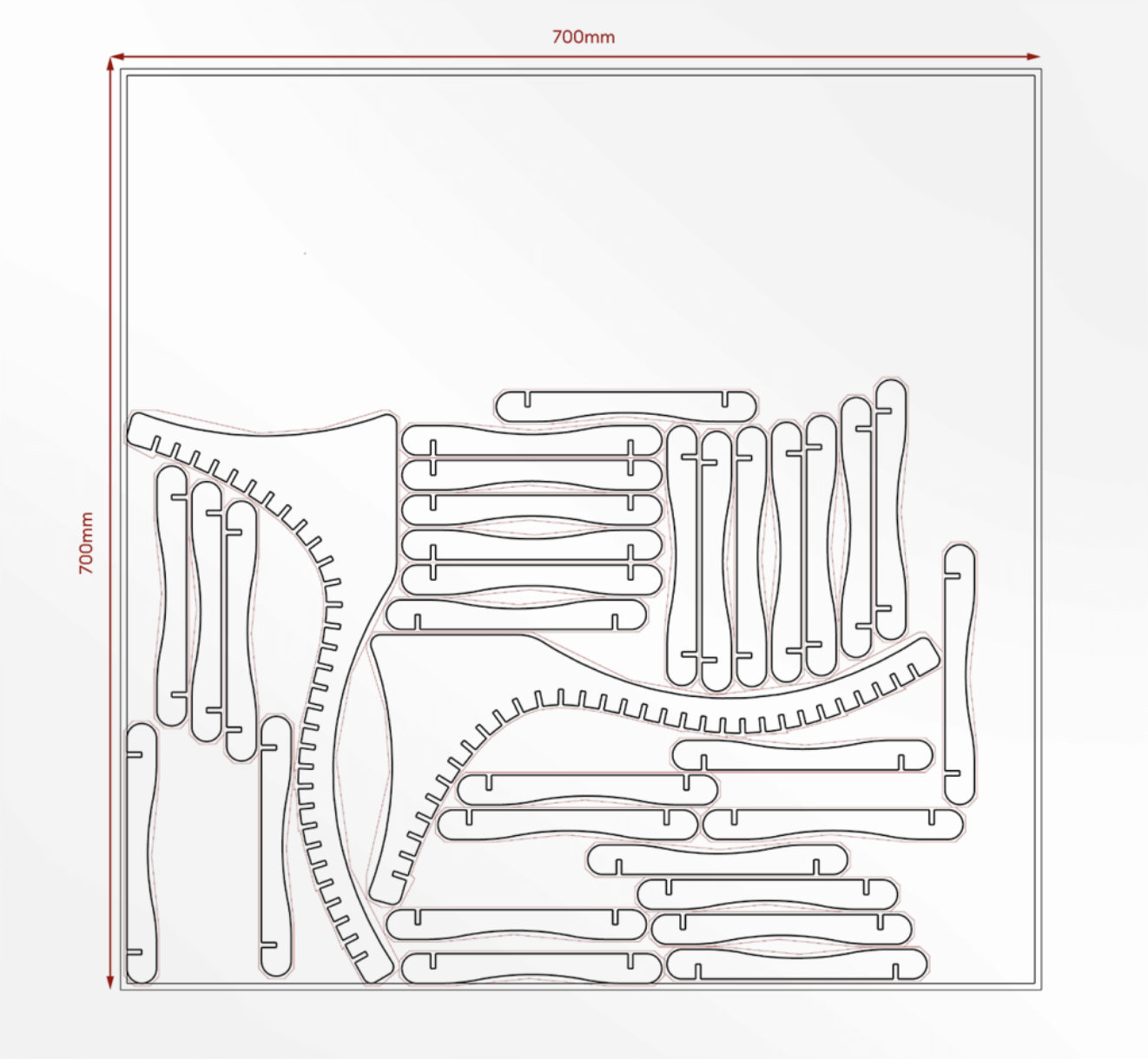
COMPUTATIONAL DESIGN WITH GRASSHOPPER

The team also used OpenNest to optimize the nesting of parts on plywood sheets, ensuring maximum efficiency.



Extrusion and assembly simulation

A scale model was first laser-cut to refine the design before moving into robotic fabrication.



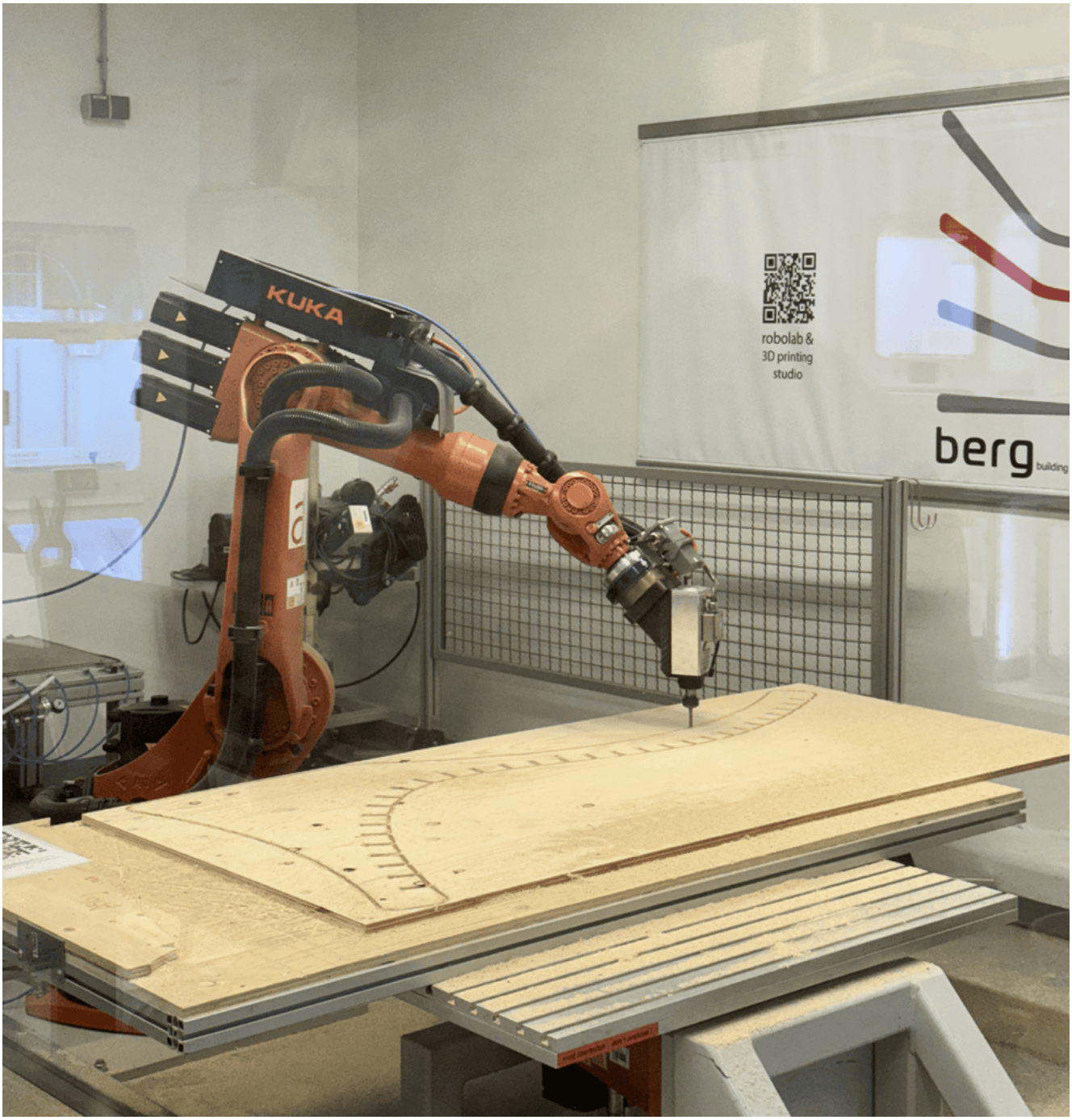
OpenNest output check

ROBOTIC FABRICATION WITH KUKA KR 16-2

Once the digital model was finalized, the workflow shifted to robotic manufacturing using the KUKA KR 16-2. Toolpath generation and simulation were carried out with KUKA|prc, allowing the team to verify movements, avoid collisions, and output the final KRL files.

The plywood panels were then cut by the robot, polished, and manually assembled by team members Osman Cagine, Zain Ahmad, and Rayees Khan. Notably, the project repurposed leftover plywood from the Shellscape Pavilion, reinforcing the course's commitment to sustainable

practices.



Milling and cutting with KUKA KR 16-2 robot

FROM EDUCATION TO EXHIBITION

The final prototype demonstrated how computational design tools, robotic fabrication, and sustainable thinking can converge to produce a lightweight yet strong piece of furniture. Showcased at Campus Fest 2025 alongside other works from the program, the chair exemplified

both the collaborative nature of the project and the future of digital design education.



The Waffle-Structured Chair is a full-scale ergonomic chair.

CREDITS

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Material Preparation & Assembly: Osman Cagine, Zain Ahmad, Rayees Khan
Professor: Juanfra García Guillén
Program: Hochschule Anhalt, DIA Master's Program, Robotic Manufacturing Elective