Oregon State University

ICD | ITKE Research Pavilion 2011

https://www.archdaily.com/200685/icditke-research-pavilion-icd-itke-university-of-stuttgart

ICD / ITKE University of Stuttgart

Bahar Abiri

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OSU Oregon State UNIVERSITY

General Specifications

Architects: ICD/ITKE University of Stuttgart

Volume: 200 m^3

Area: 72 m^2

Material: extremely thin sheets of plywood (6.5 mm).

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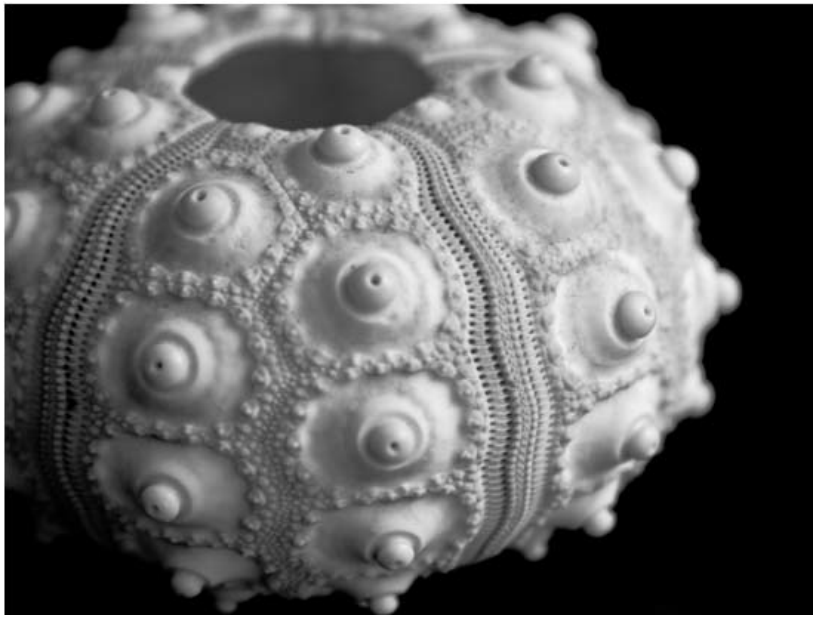
Bionic Structure

- The project explores the architectural transfer of biological principles of the **sea urchin's plate skeleton** morphology by means of novel computer-based design and simulation methods
- Possibility of effectively **extending** the recognized **bionic principles**
- Related performance to a range of **different geometries** through computational processes



https://www.researchgate.net/figure/Detail-of-sea-urchins-plate-structure_fig3_291351616

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Project Aim

- Integrating the performative capacity of **biological structures** into **architectural design**
- Testing the resulting spatial and **structural material-systems** in full scale.
- Development of a modular system
- Allows a high degree of **adaptability and performance** due to the **geometric differentiation** of its plate components

http://www.knstrct.com/art-blog/2011/12/20/icd-itke-research-pavilion-2011

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Biological System

Sand Dollar

- **Modular system** of polygonal plates
- Linked together at the edges by **finger-like** calcite protrusions
- **High load bearing** capacity is achieved by the **particular geometric arrangement** of the **plates** and their **joining system**
- Serves as a most fitting model for shells

The morphology of its plate structure was integrated in the design of a pavilion

https://images-na.ssl-images-amazon.com/images/I/71l-lVY7-yL._SL1500_.jpg

https://fineartamerica.com/featured/sand-dollar-mike-mcglothlen.html

Construction

- 3 plate edges always meet together at just 1 point
- Enables the transmission of **normal** and **shear forces** but **no bending moments between the joints**
- Resulting in a **bending bearing** but yet deformable structure
- **High lightweight** potential , could be built out of 6.5 mm thin sheets of plywood only, despite its considerable size
- Needed anchoring to the ground to resist wind suction loads.

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Structure

- The cell sizes are **not constant**, but **adapt** to local curvature and discontinuities.
- Organized as **a two-level** hierarchical structure:
    1. The **finger joints** of the plywood sheets, **glued** together to form a cell
    2. A simple **screw connection** joins the cells together, **allowing the assembling and disassembling** of the pavilion.

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Conclusion

https://vimeo.com/48374170

The research pavilion offered :

- The opportunity to investigate methods **of modular bionic construction** using **freeform surfaces**
- Representing **different geometric** characteristics
- Developing two distinct spatial entities:
  1. **One large interior space** with a **porous inner layer** and a **big opening**
  2. Smaller interstitial space enveloped between the two layers that exhibits the constructive logic of the double layer shell.

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References:

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