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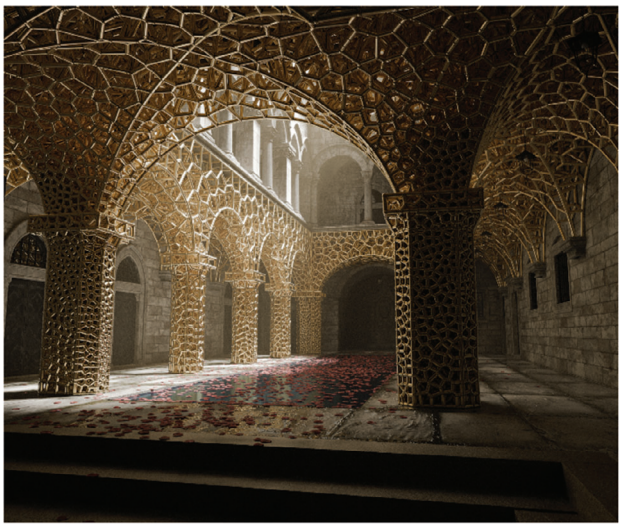
2025 Cover Image

Lightweight Voronoi Sponza



***Lightweight Voronoi Sponza* by Dennis R. Bukenberger**

Description: Lightweight design structures reduce costs and the environmental footprint of resource-intensive industries by minimizing material use, thus lowering energy consumption during operation. In our paper [WBN*25], we present a 3D material deposition strategy, based on a stress-adaptive Voronoi diagram. Site density is increased in regions of higher stress and reduced in less critical areas. The result is an efficient distribution of the constrained material budget (in this example 50 % of the solid structure), ensuring optimal mechanical performance. For this illustration, we modified the Sponza scene, replacing all load-bearing structures on the ground floor with our custom stress-optimized 3D Voronoi design. The image was rendered using Blender.

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Author bios:

Dennis R. Bukenberger received his doctoral degree in computer science from the University of Tübingen in 2021. As a postdoc at TU Dortmund, he continued his work on meshing techniques utilizing Voronoi diagrams and developed optimization methods for meshes in computational simulations. Currently, his research at TU Munich, in collaboration with TU Delft, is focused on improving the structural compliance of mesh structures for future use in sustainable manufacturing techniques.

Reference

[WBN*25] Wang, J., Bukenberger, D. R., Niedermayr, S., Neuhauser, C., Wu, J., Westermann, R. (2025). SGLDBench: A Benchmark Suite for Stress-Guided Lightweight 3D Designs. arXiv preprint https://doi.org/10.48550/arXiv.2501.03068

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