



Glas, Stahl und Geometrie

Mathematik in der modernen Architektur

Stefan Sechelmann



Tanzendes Haus, Frank Gehry, Prag 1996









U-Bahn Ausgang in Paris



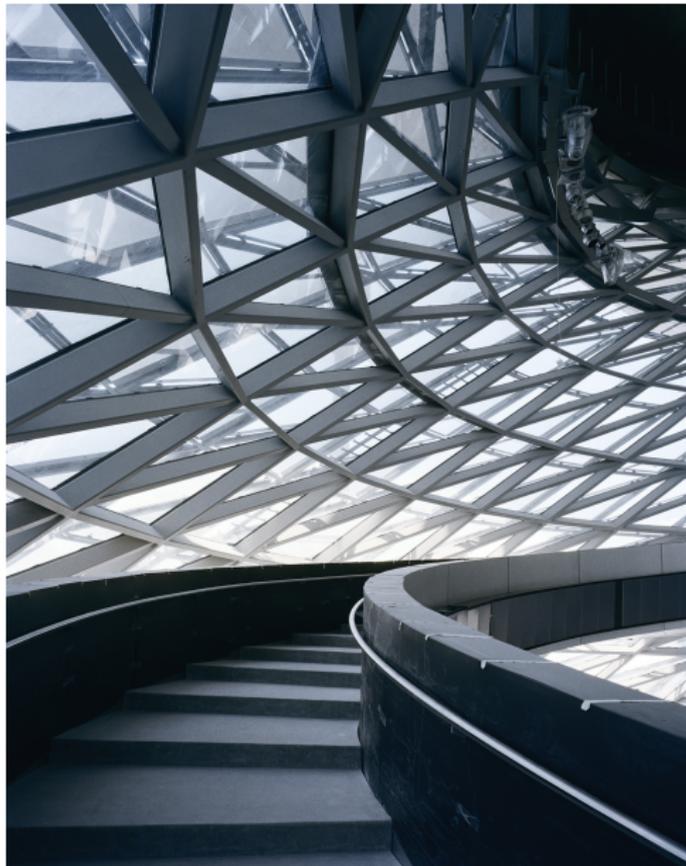
U-Bahn Ausgang Saint Lazare Paris RFR Ingenieure

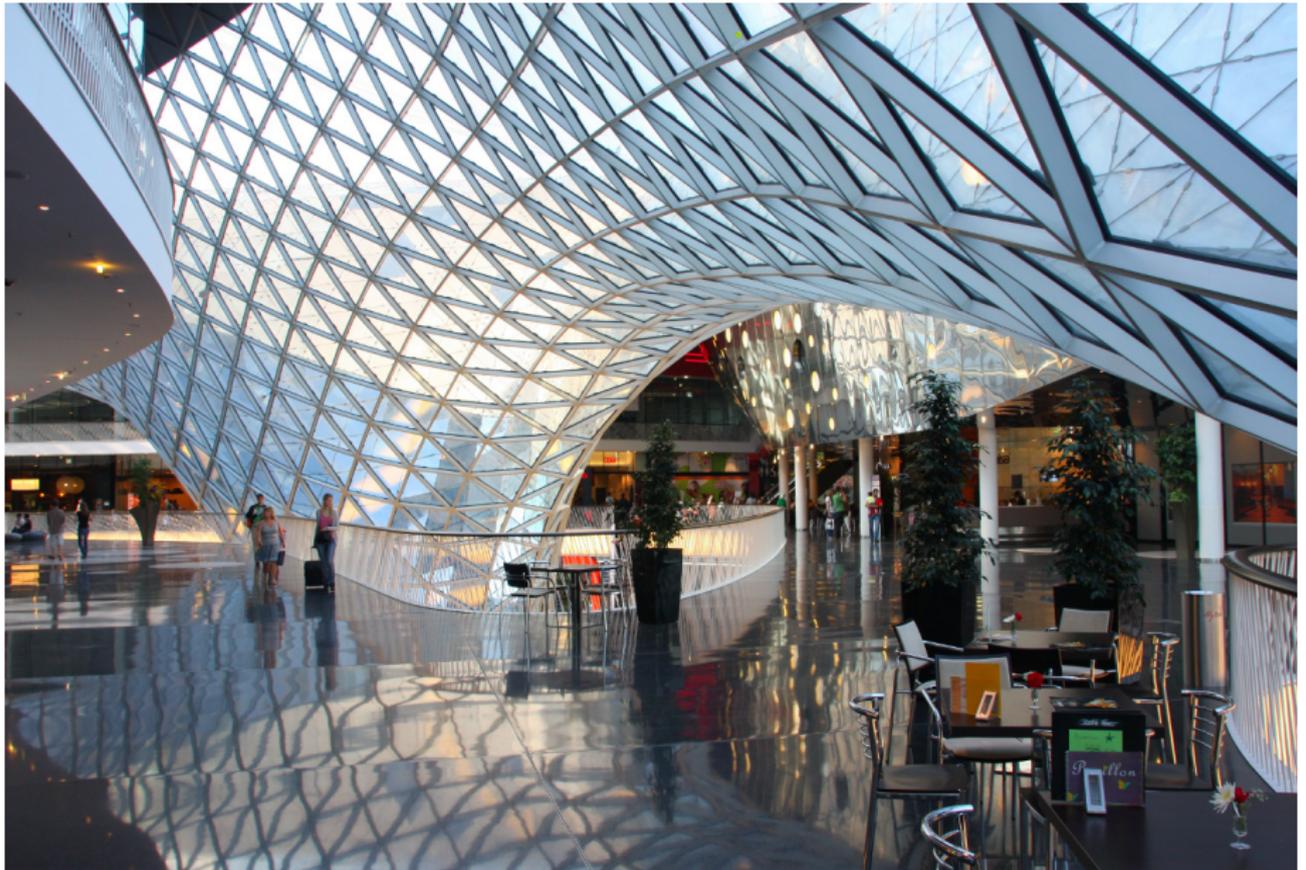






Rigatoni@07





MyZeil Frankfurt



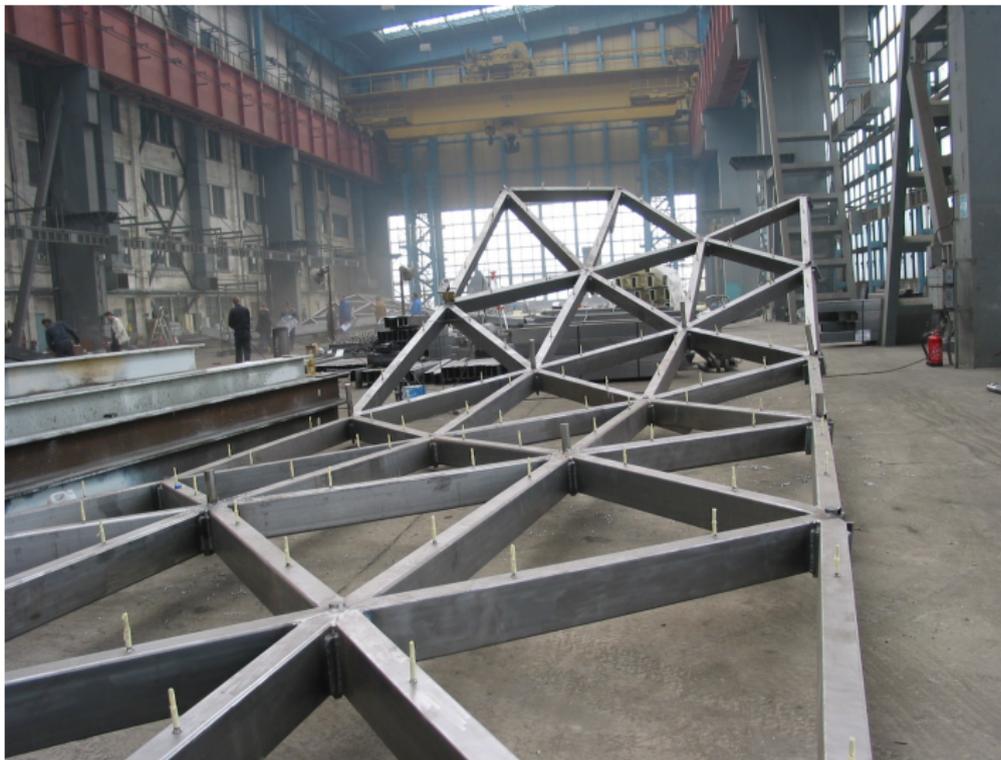


MyZeil 3D

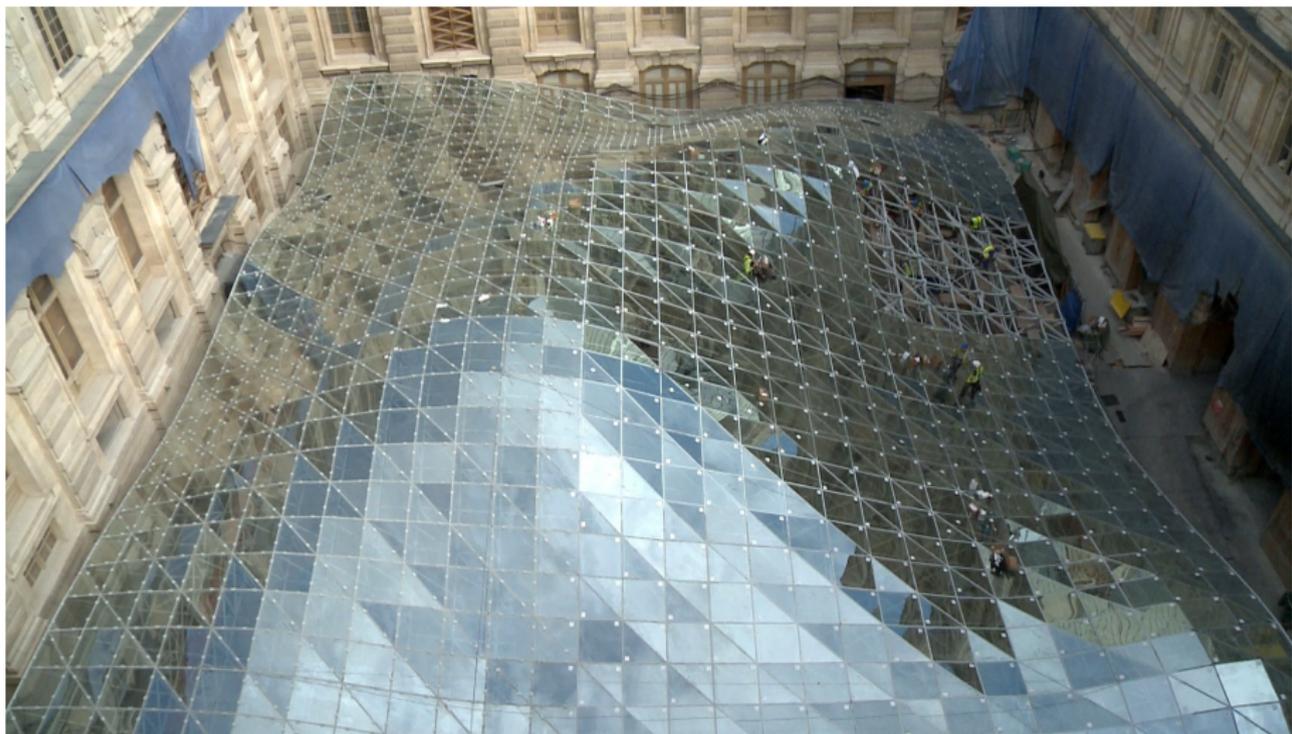


Dreiecksgitter in Computerspielen

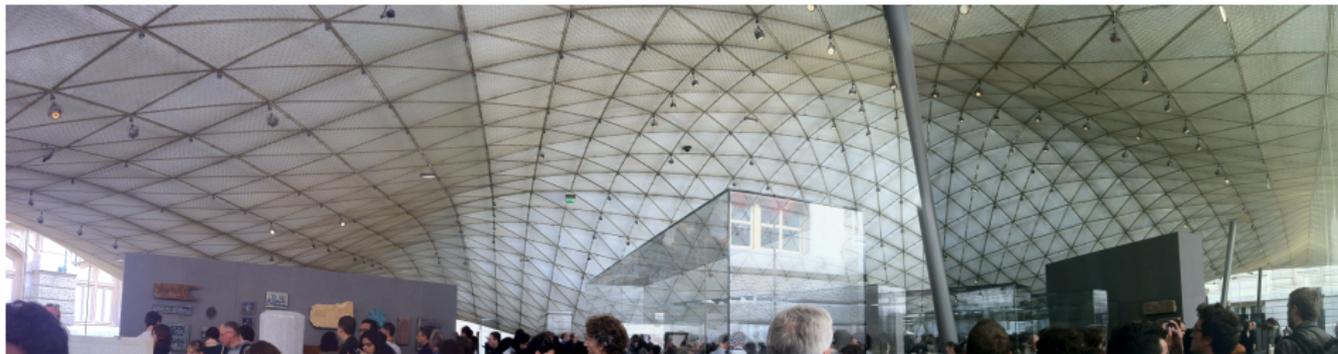






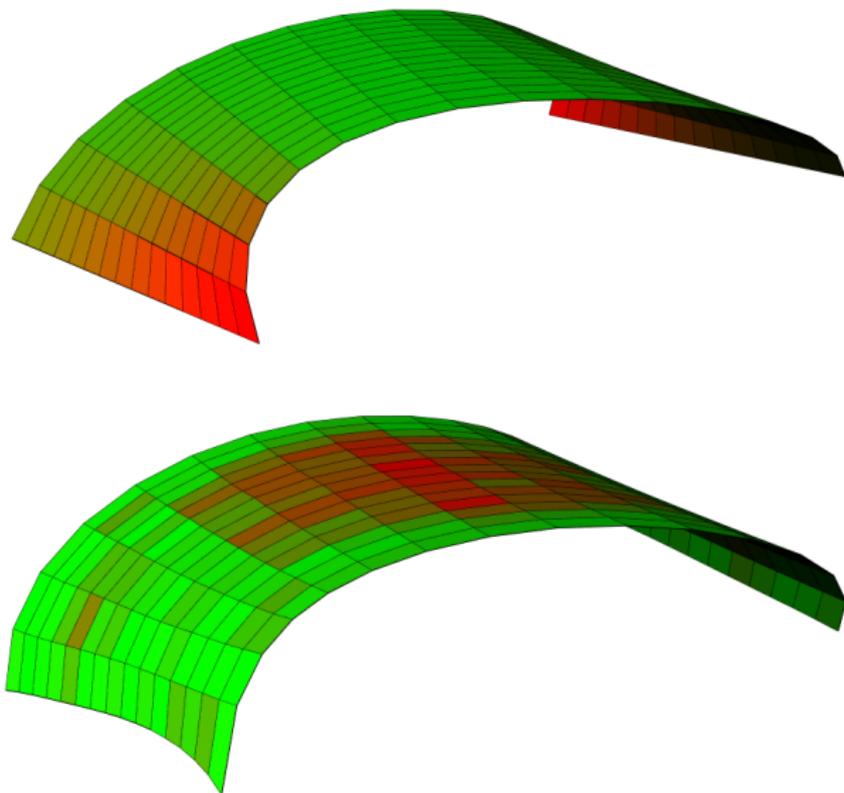






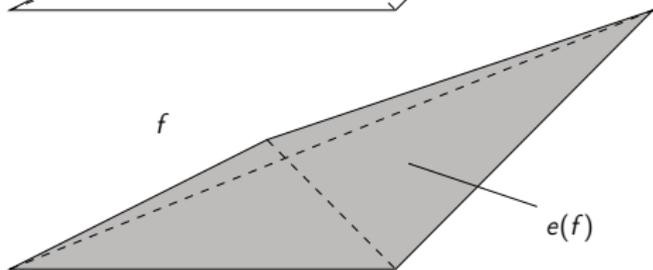
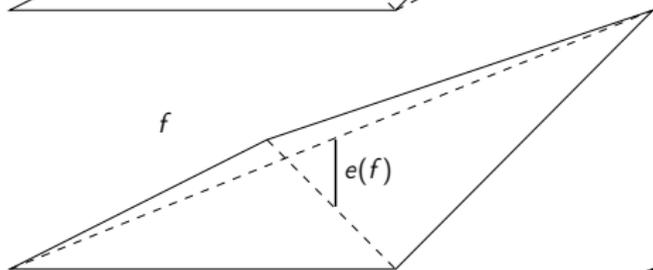
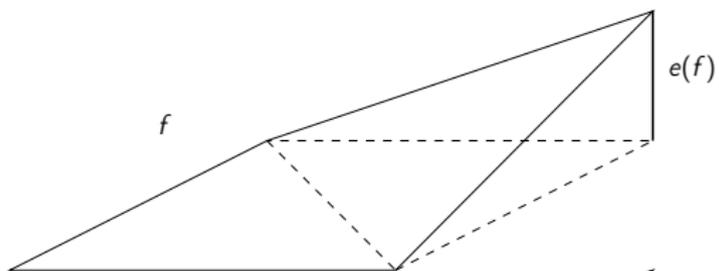


Louvre





Verschiedene Definitionen von Ebenheit





$$\begin{aligned} E(M) &= \sum_{f_i \in M} e(f_i) \\ &= e(f_1) + e(f_2) + \dots + e(f_n) \end{aligned}$$

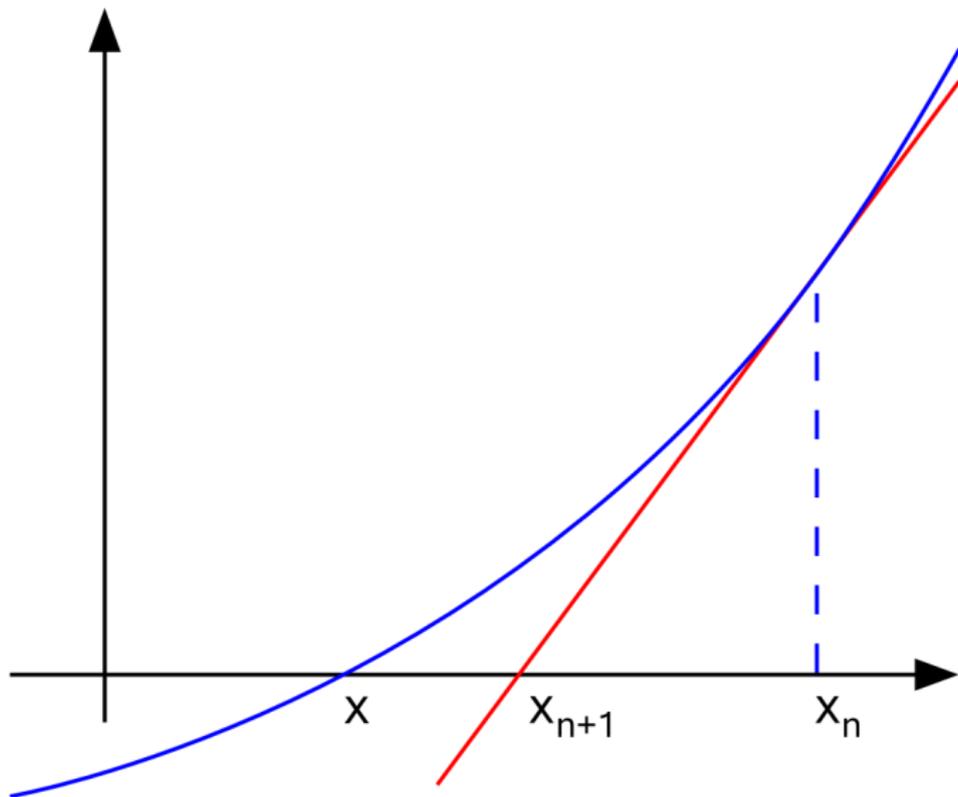
- M - alle Glasscheiben
- f_i - i -te Glasscheibe
- $e(f_i)$ - Energie/Unebenheit der i -ten Glasscheibe
- $E(M)$ - Energie/Unebenheit der gesamten Oberfläche



$$\begin{aligned} E(M) &= \sum_{f_i \in M} e(f_i) \\ &= e(f_1) + e(f_2) + \cdots + e(f_n) \end{aligned}$$

Ziel

$$\begin{aligned} E(M) &= \textit{klein} \\ E'(M) &= 0 \end{aligned}$$



Demo Planarisierung

VaryLab[Ultimate]

File Viewer Camera Content Window Properties Halfedge XploreMath Look and Feel Help

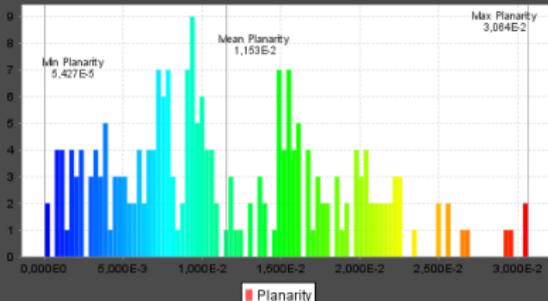
DomainVisualizationPlugin
Halfedge Data Visualization

Configuration Histogram Table

Planarity Node Colors
Planarity Histogram

Options

Front



Min Planarity 5.427E-5
Mean Planarity 1.153E2
Max Planarity 3.064E2

Planarity

Surface Remeshing
Discrete Conformal Parametrization
Optimizer Plugins

Normalize Energies

Optimizer Plugins

- Opposite Angles ... 1
- Opposite Edges ... 0,001
- Planar N-Gons 1
- Planar Quads 1
- Reference Surfac... 1
- Spring Energy 1
- Touching Cot.In... 1
- Willmore Energy 1

Plugin Options

- Volume
- Diagonal Distance

Optimization

Constraints

Global X Y Z

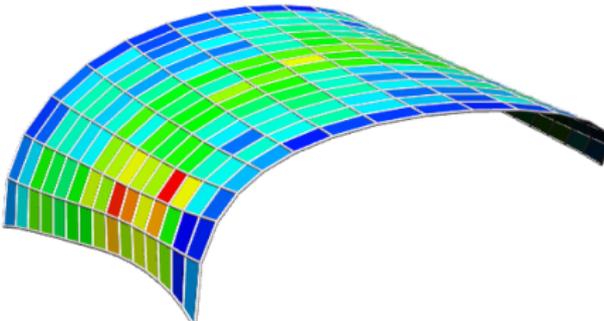
Selection X Y Z

Boundary X Y Z

- Allow Inner Boundary Movements
- Tangential
- Smooth Gradient
- SmoothSurface

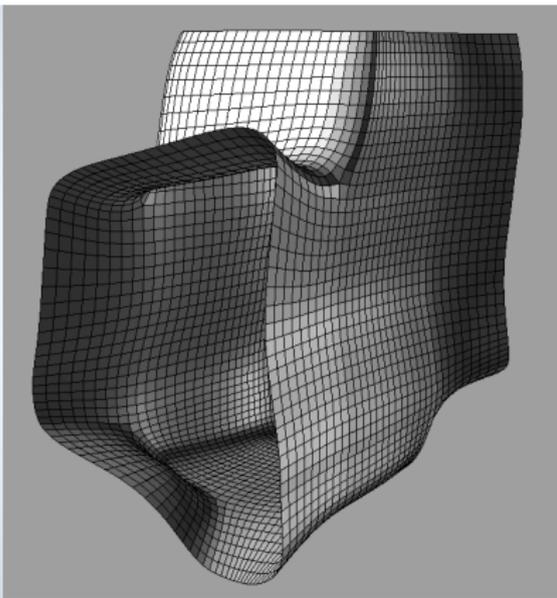
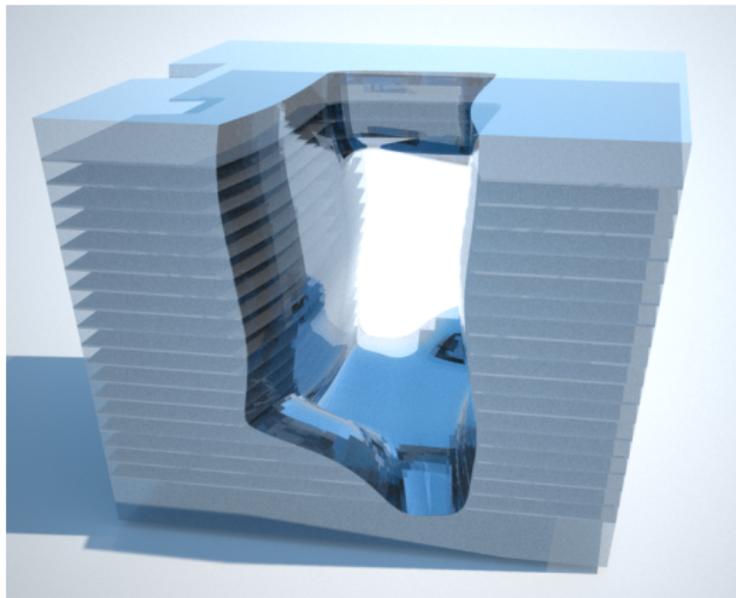
Fix Height

Tolerance -8



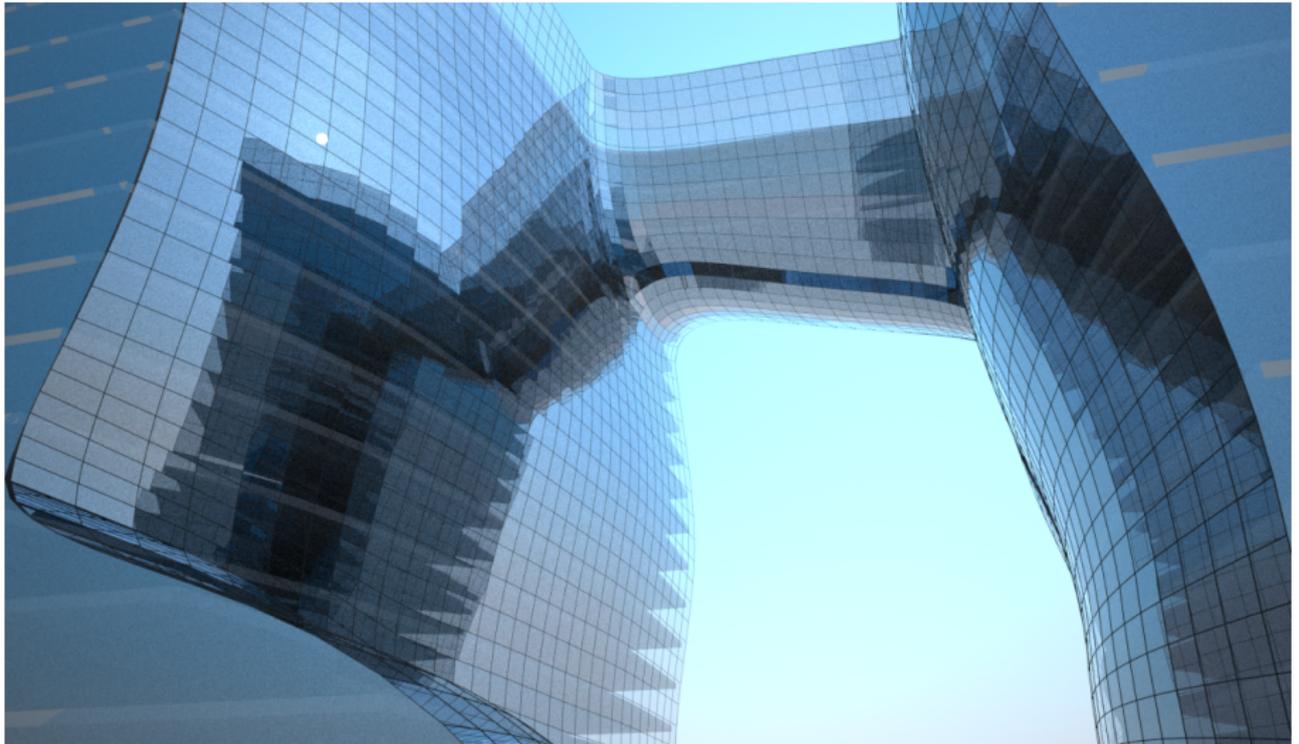


The Opus, Zaha Hadid Architekten 2011

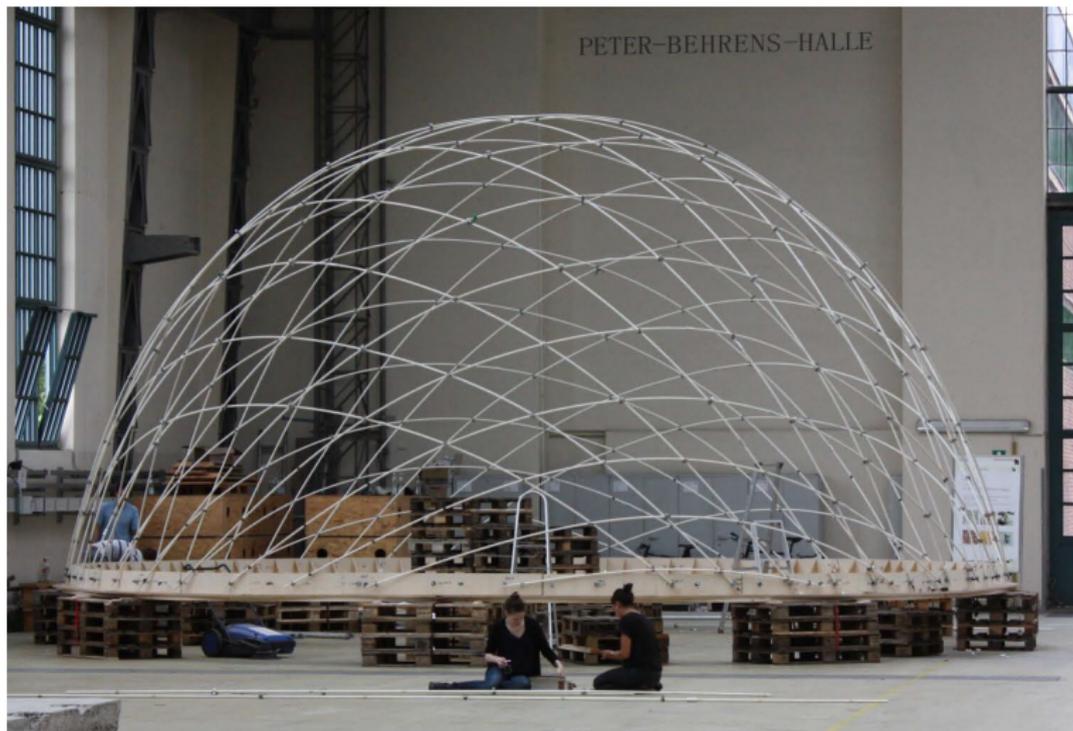




The Opus, Zaha Hadid Architekten 2011











$$E = E_{\text{Referenz}} + E_{\text{Laenge}} + E_{\text{Kruemmung}}$$

