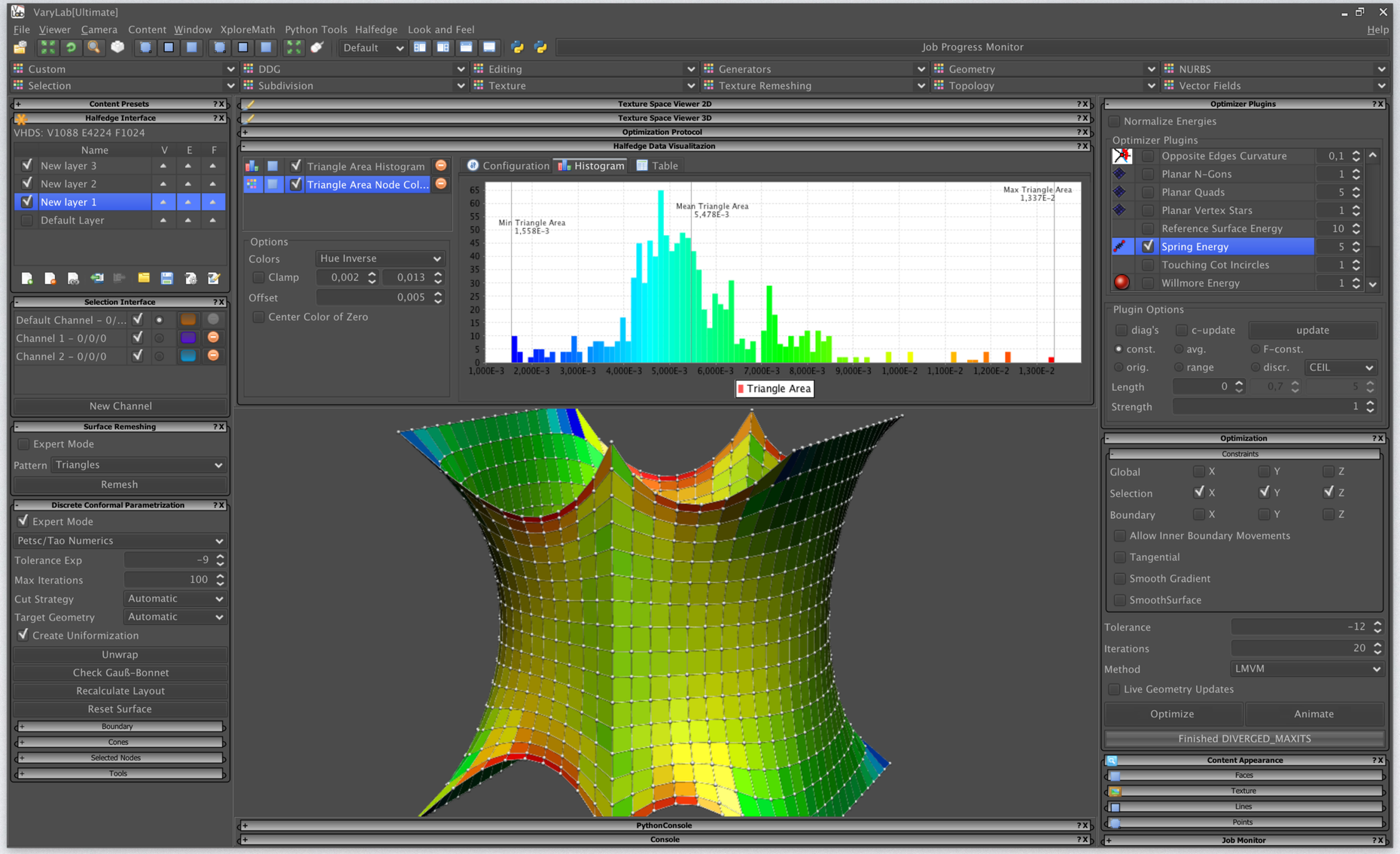
Discrete Surface Optimization

Stefan Sechelmann
joint work with
Thilo Rörig and others

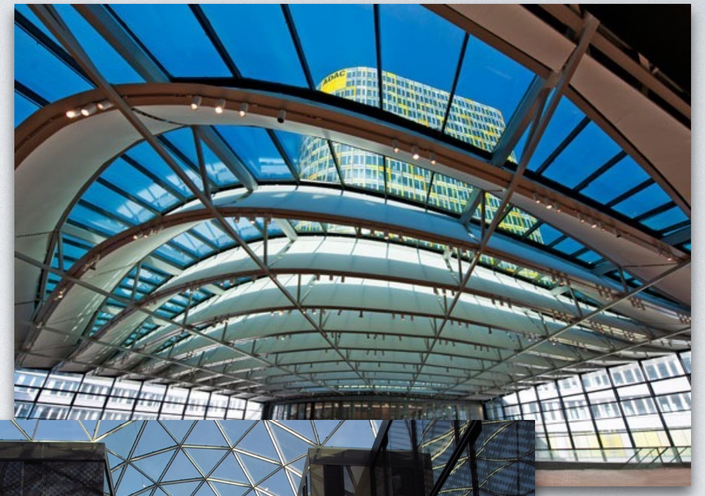
DGD | SFB TRR 109 | Discretization in Geometry and Dynamics

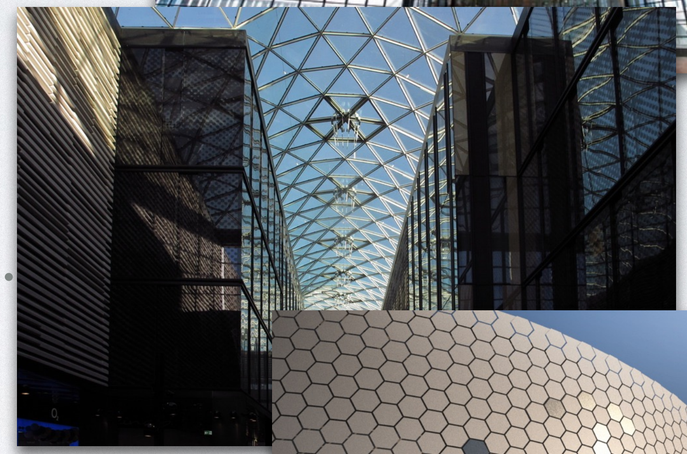


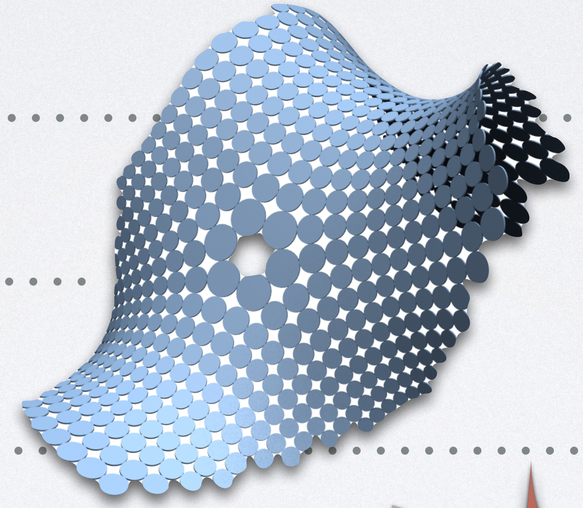
SFB TRR 109 | Discretization in Geometry and Dynamics

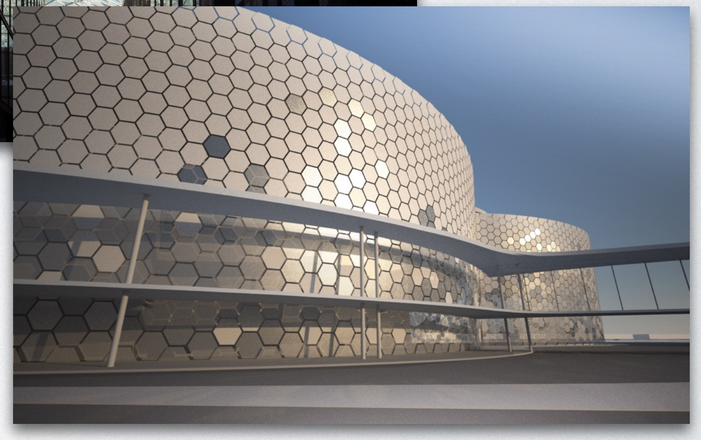
History

- 2007 - ADAC Building Munich
- 2010 - First version of VaryLab
- 2011 - Höfe am Brühl Leipzig
- 2012 - AAG
- 2014 - AAG with HENN
- 2015 - Start of invited Beta





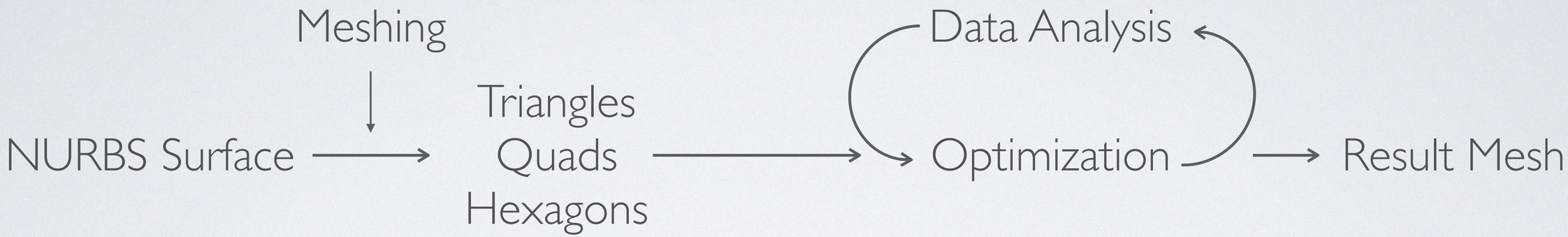


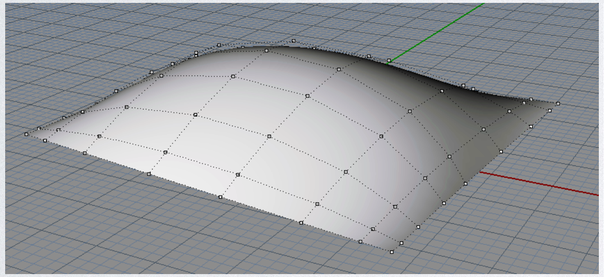


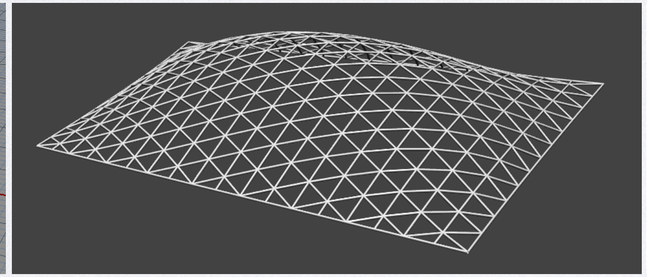
VaryLab ultimate ©2015

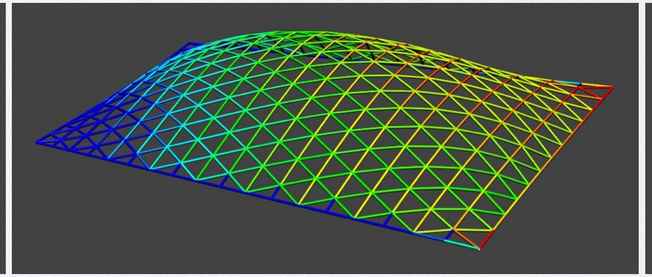
DGD | SFB TRR 109 | Discretization in Geometry and Dynamics

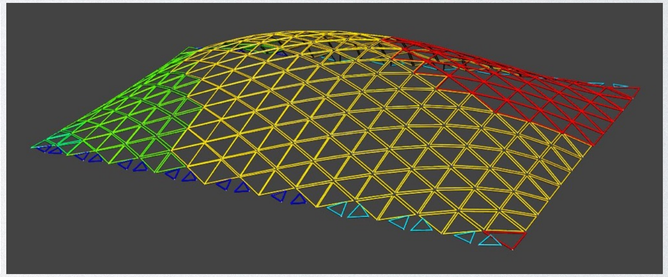
Discrete Surface Optimization



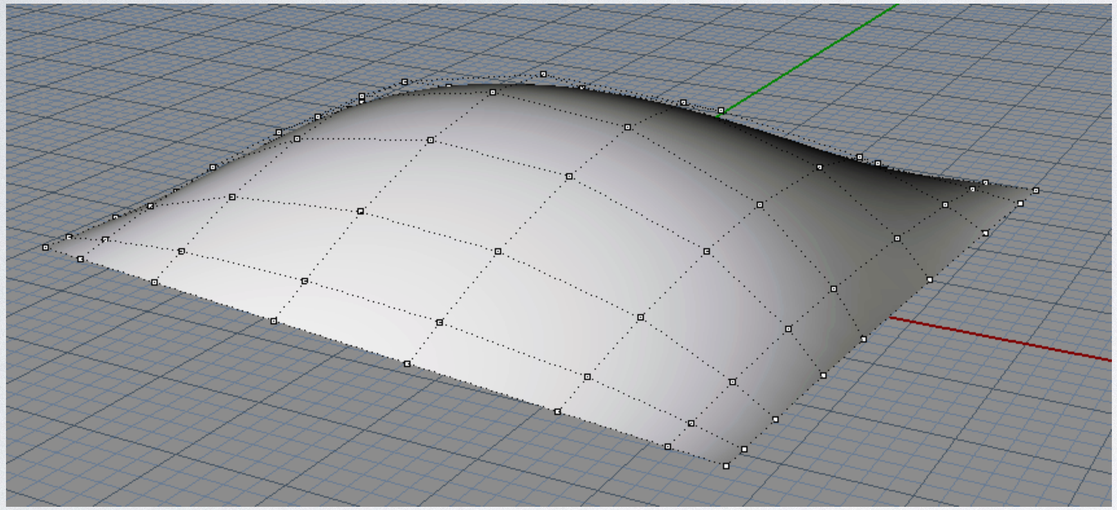


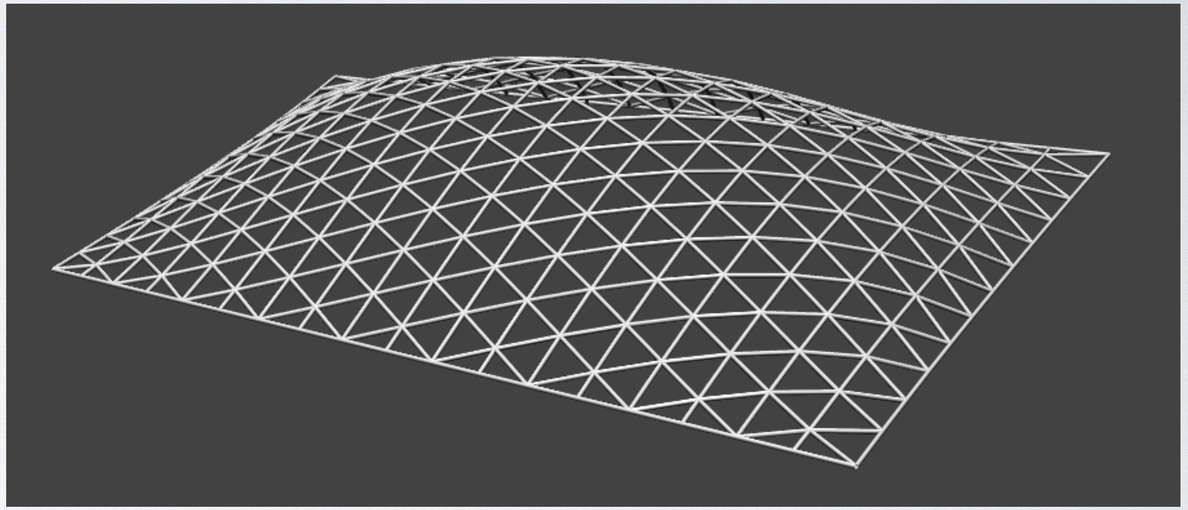




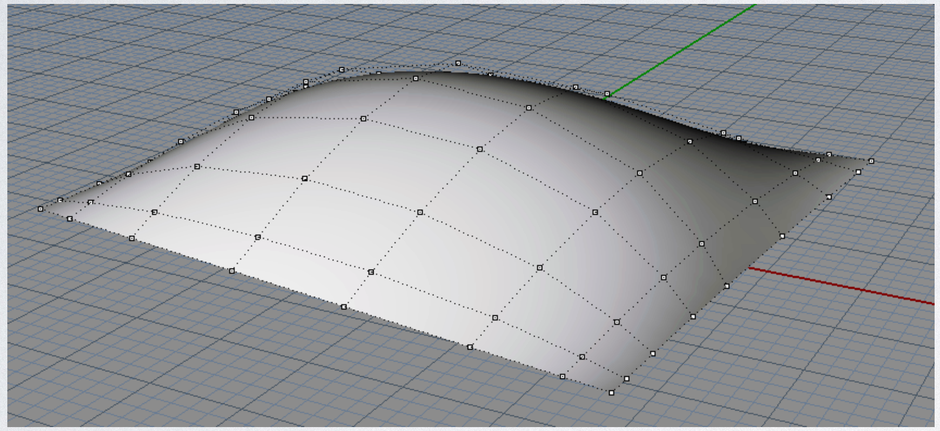


Meshing

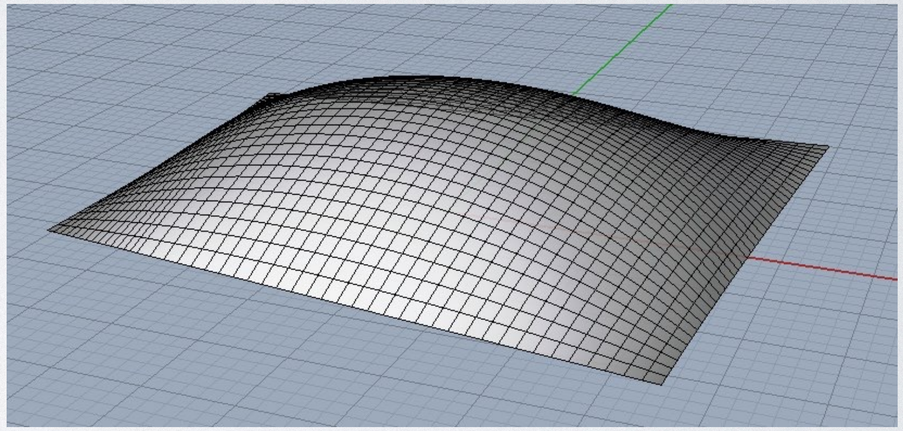




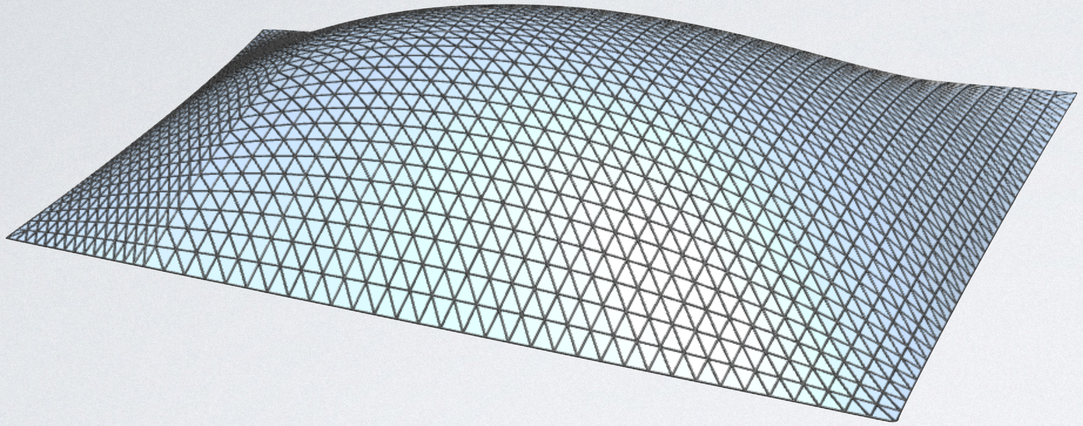
UV Meshing

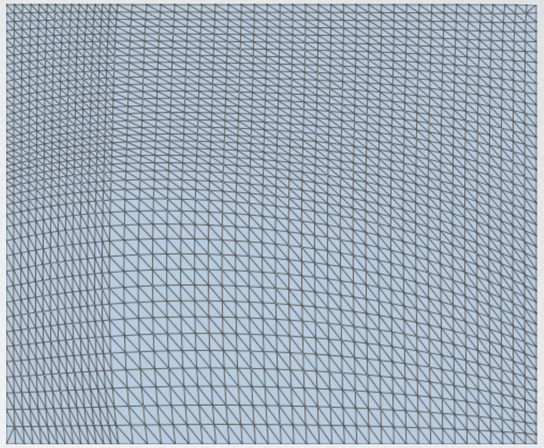


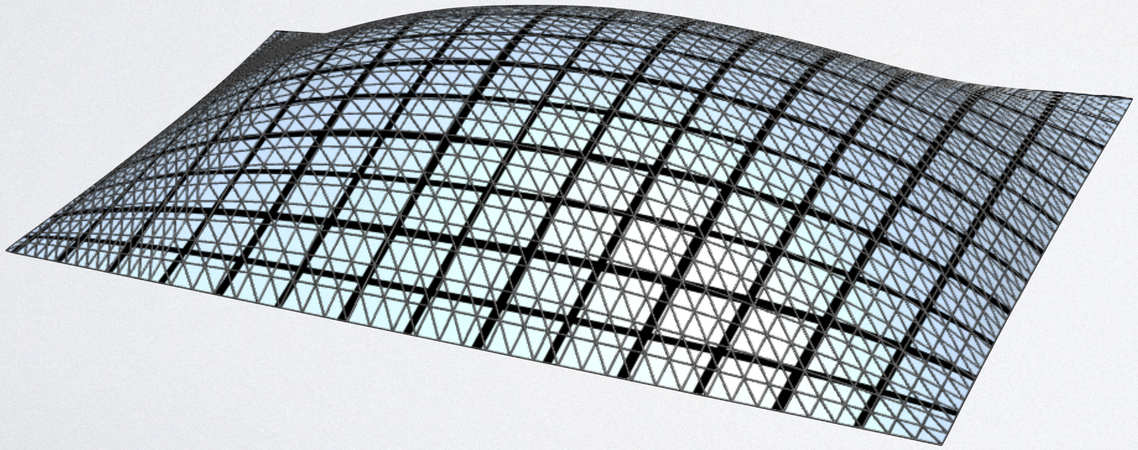
UV Meshing

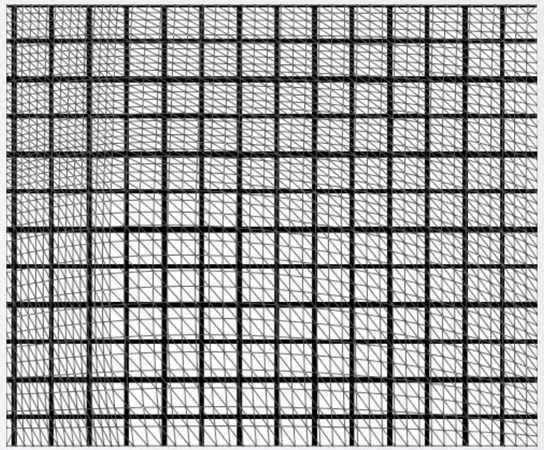


Discrete Conformal Mapping



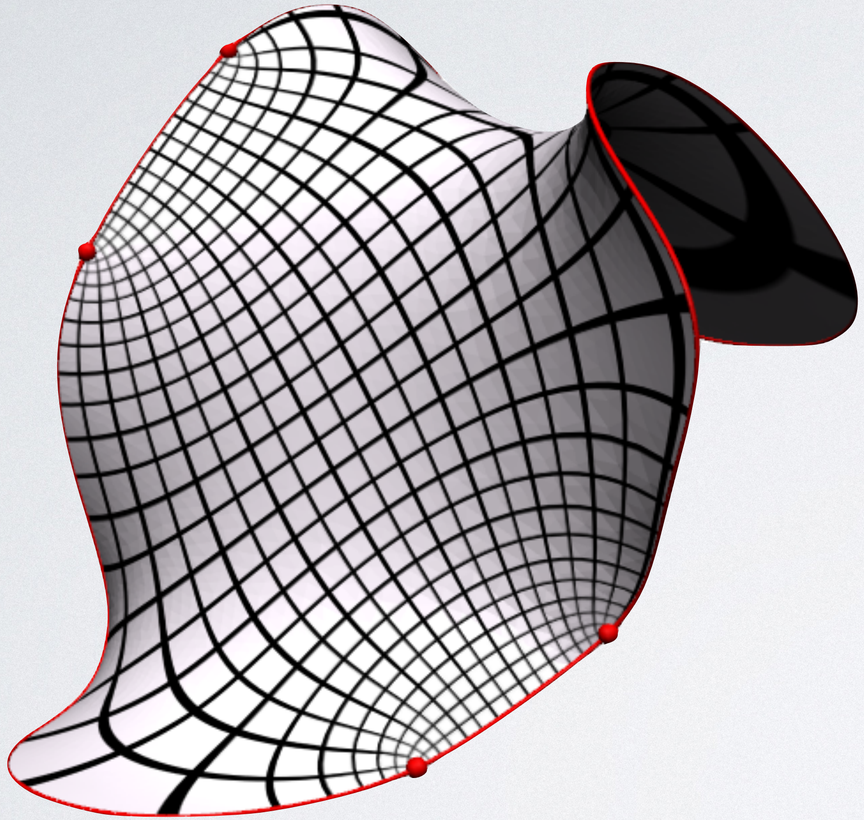




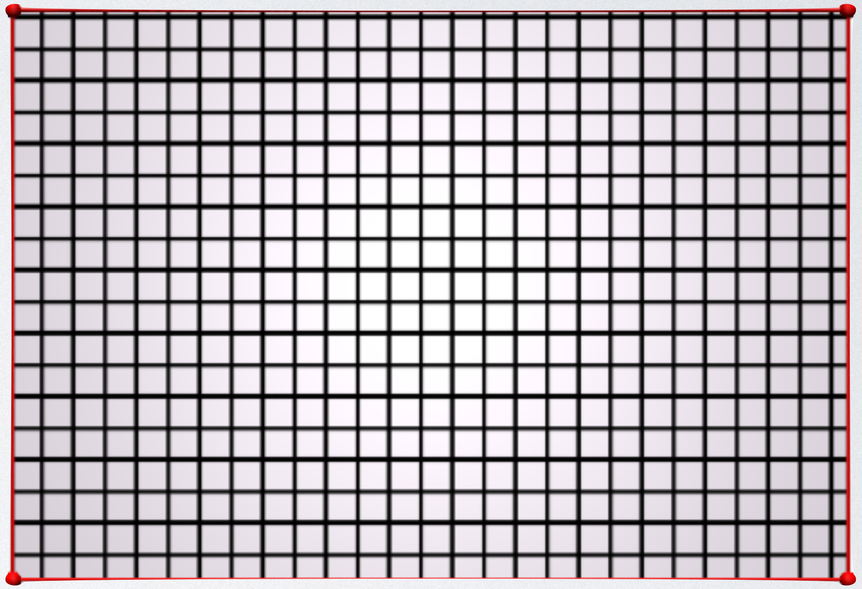


DGD | SFB TRR 109 | Discretization in Geometry and Dynamics

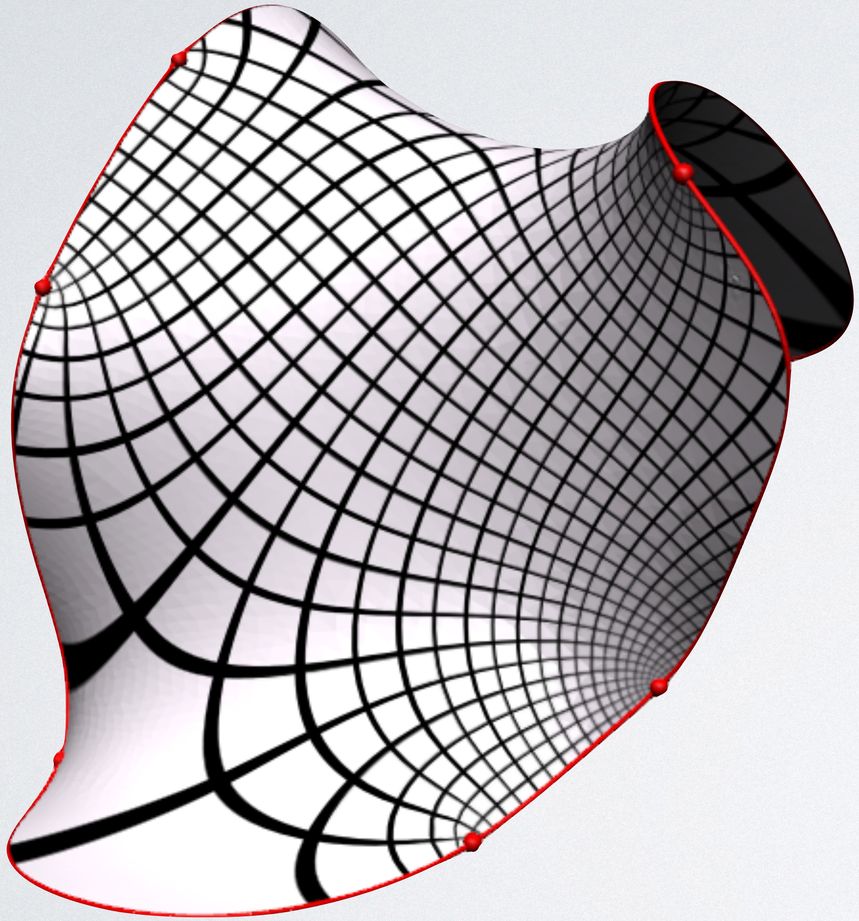
Conformal Parameterization



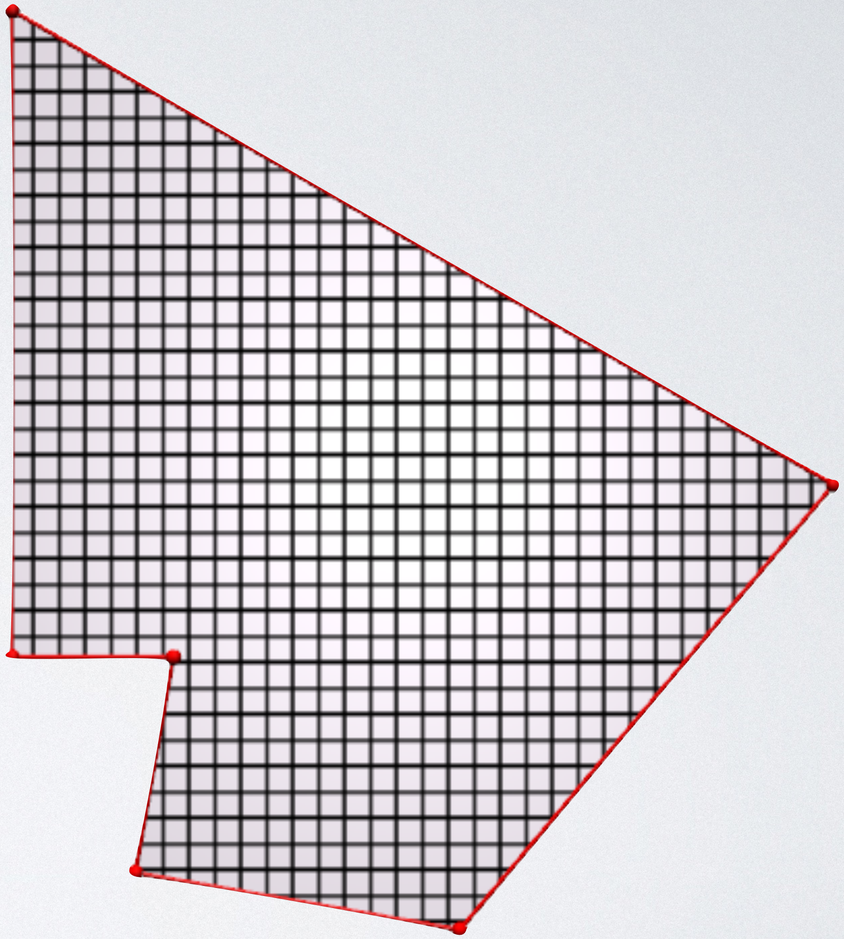
Parameterization



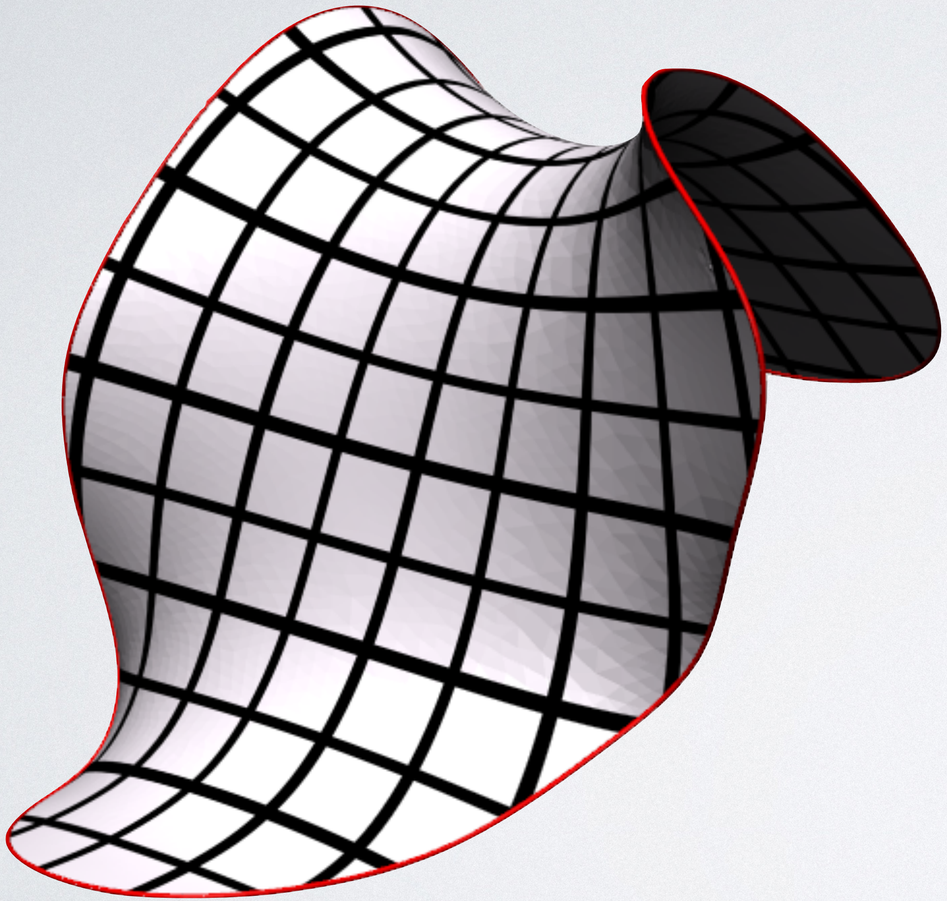
Conformal Parameterization



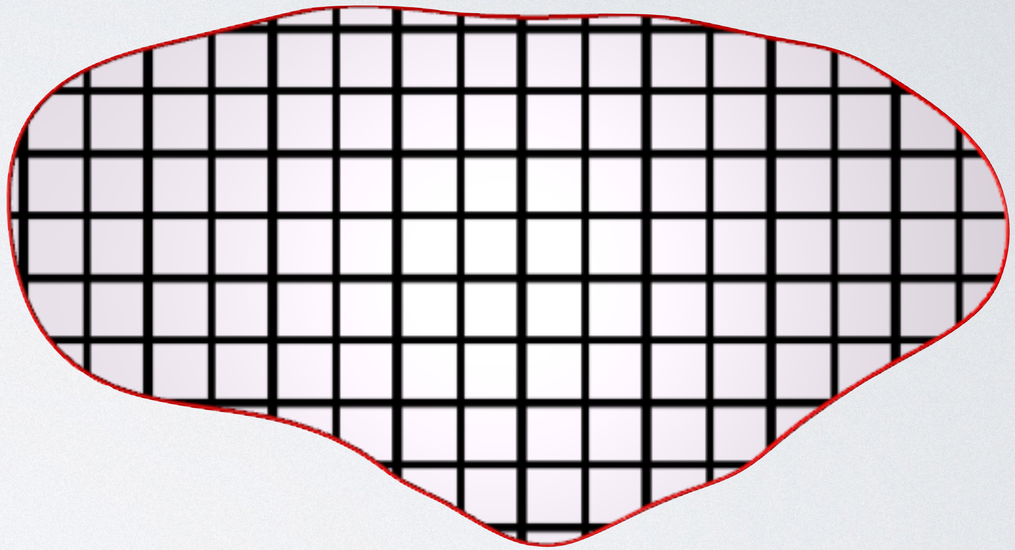
Parameterization



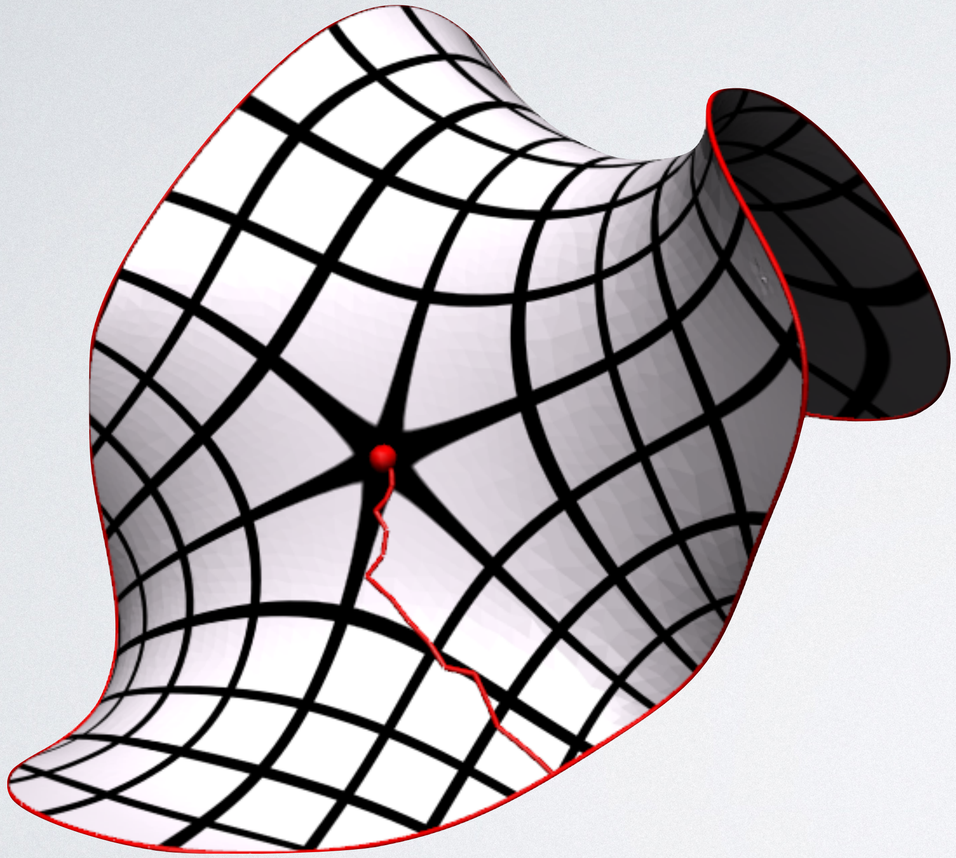
Conformal Parameterization



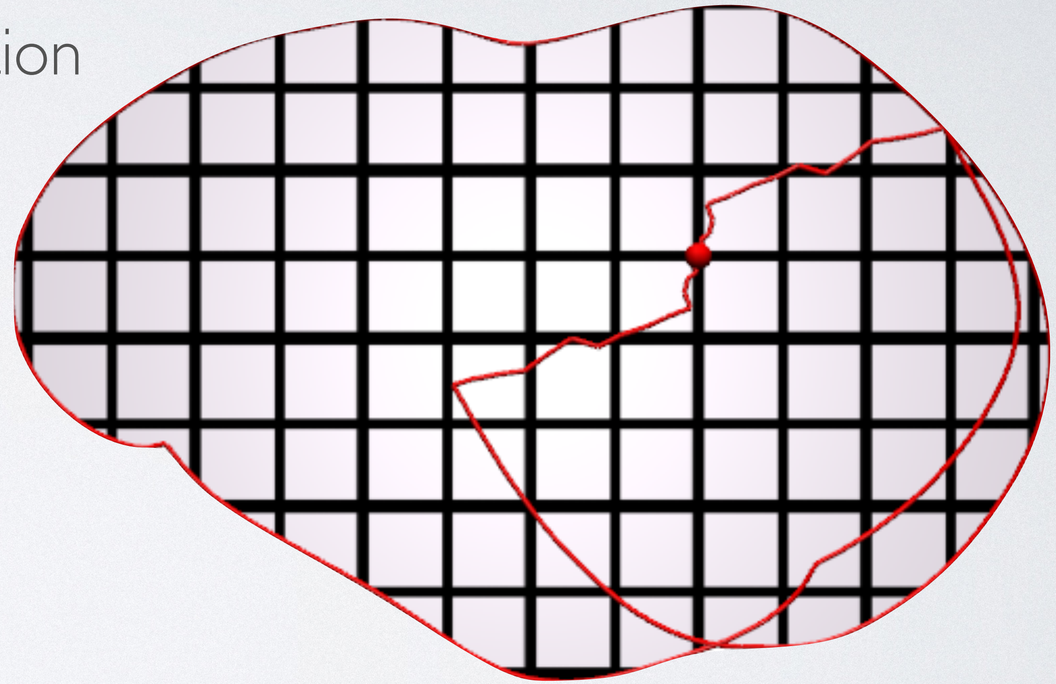
Parameterization



Conformal Parameterization

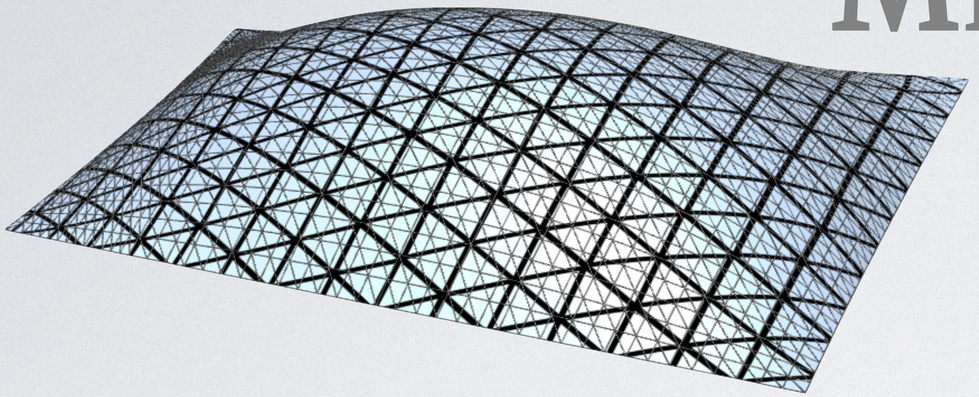


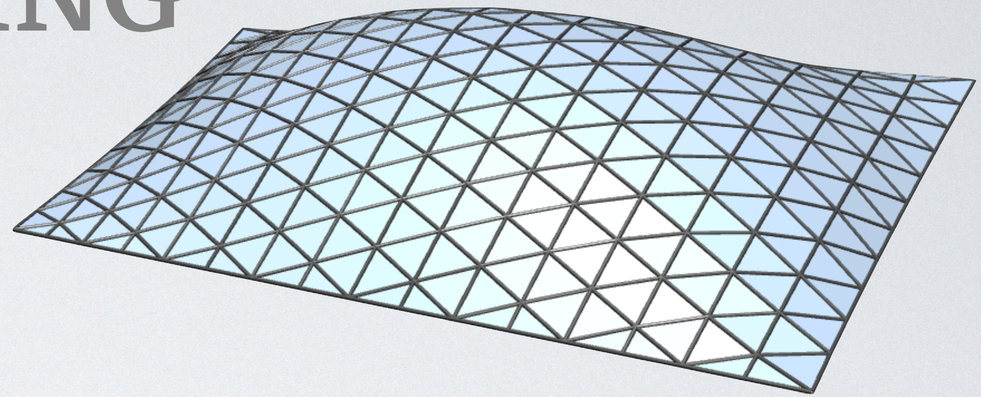
Parameterization

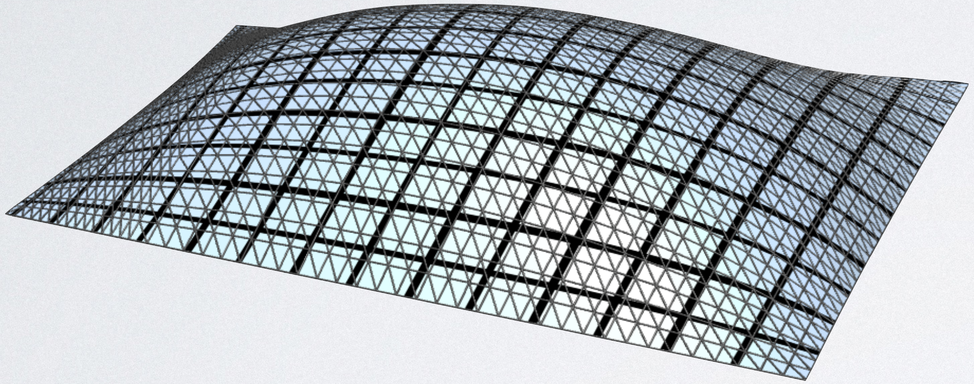


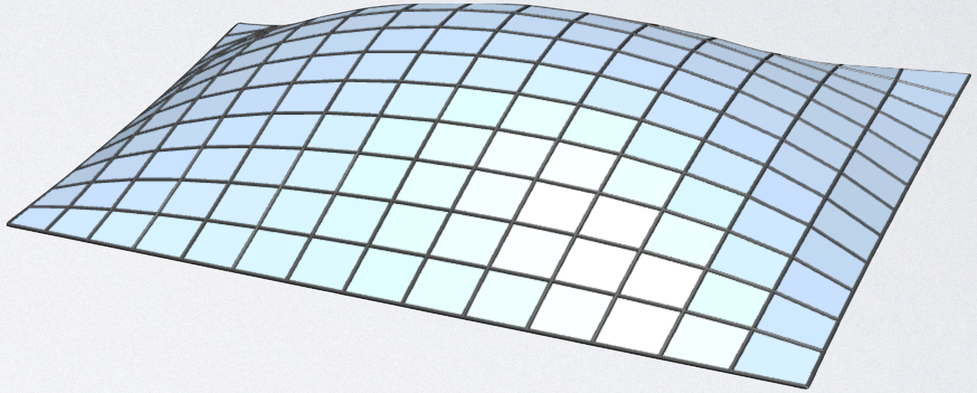
Conformal Mapping Demo

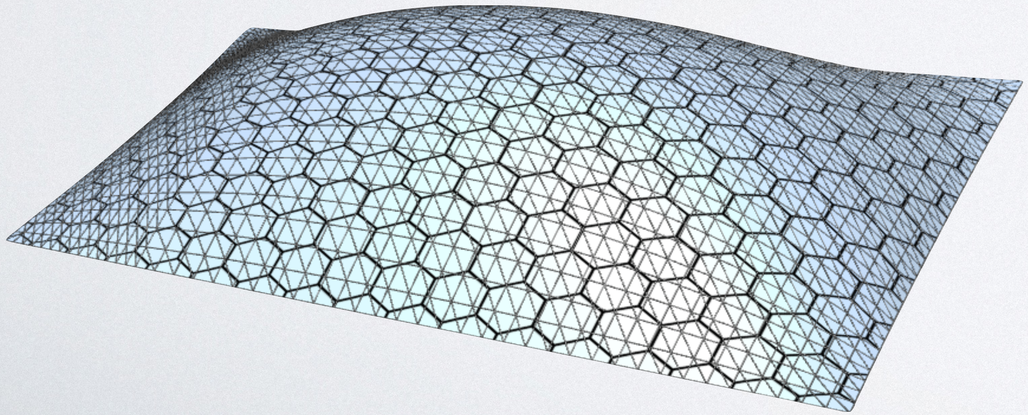
Meshing

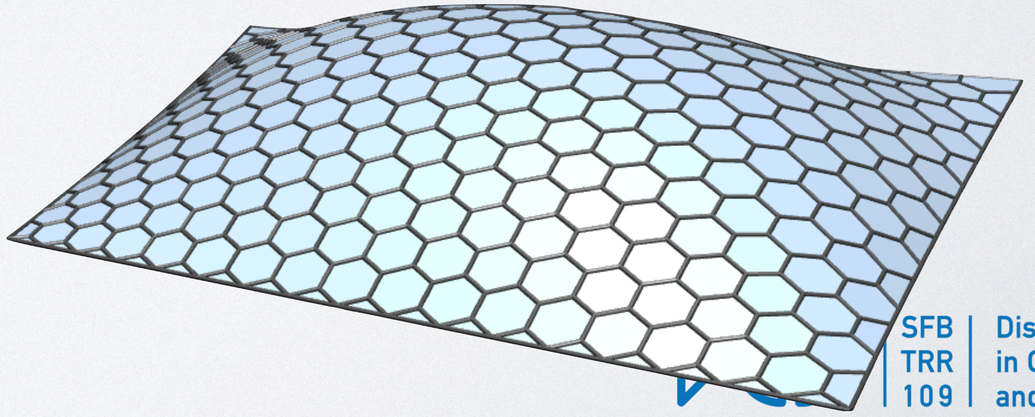




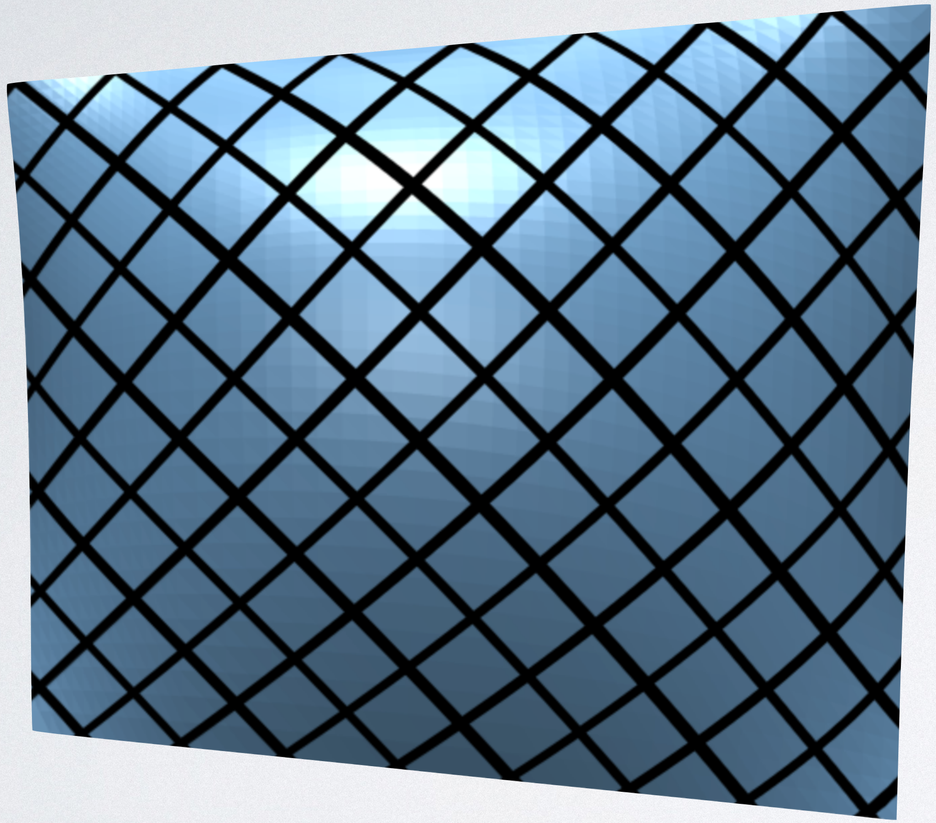


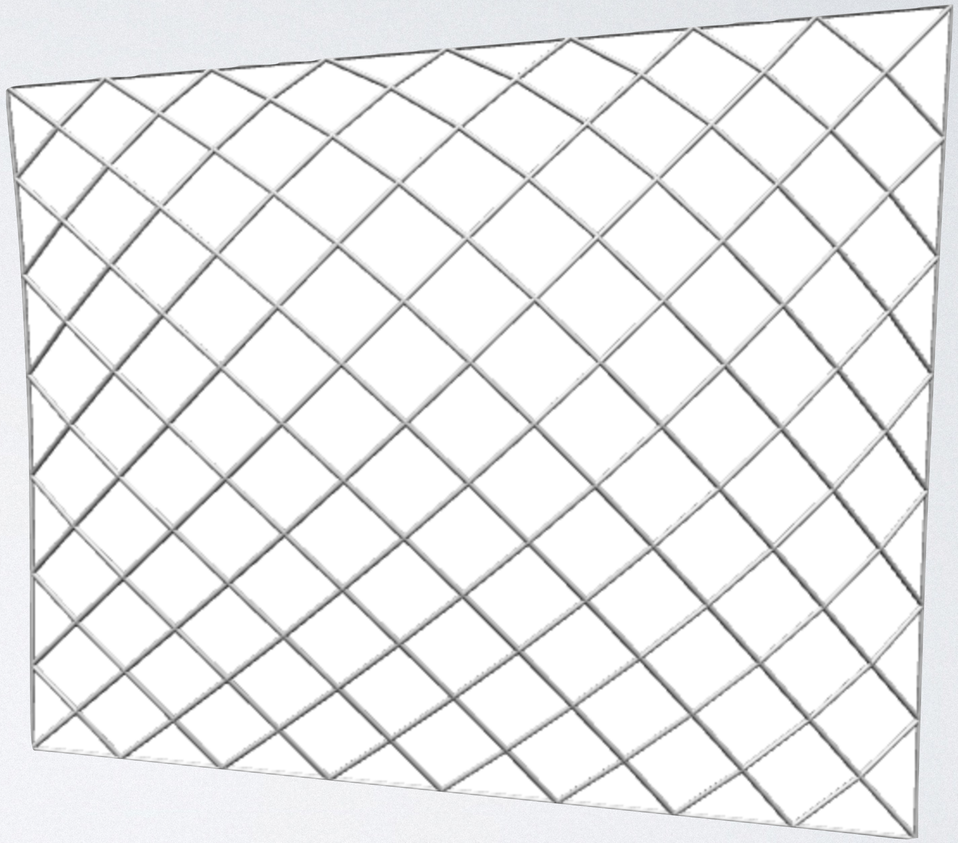




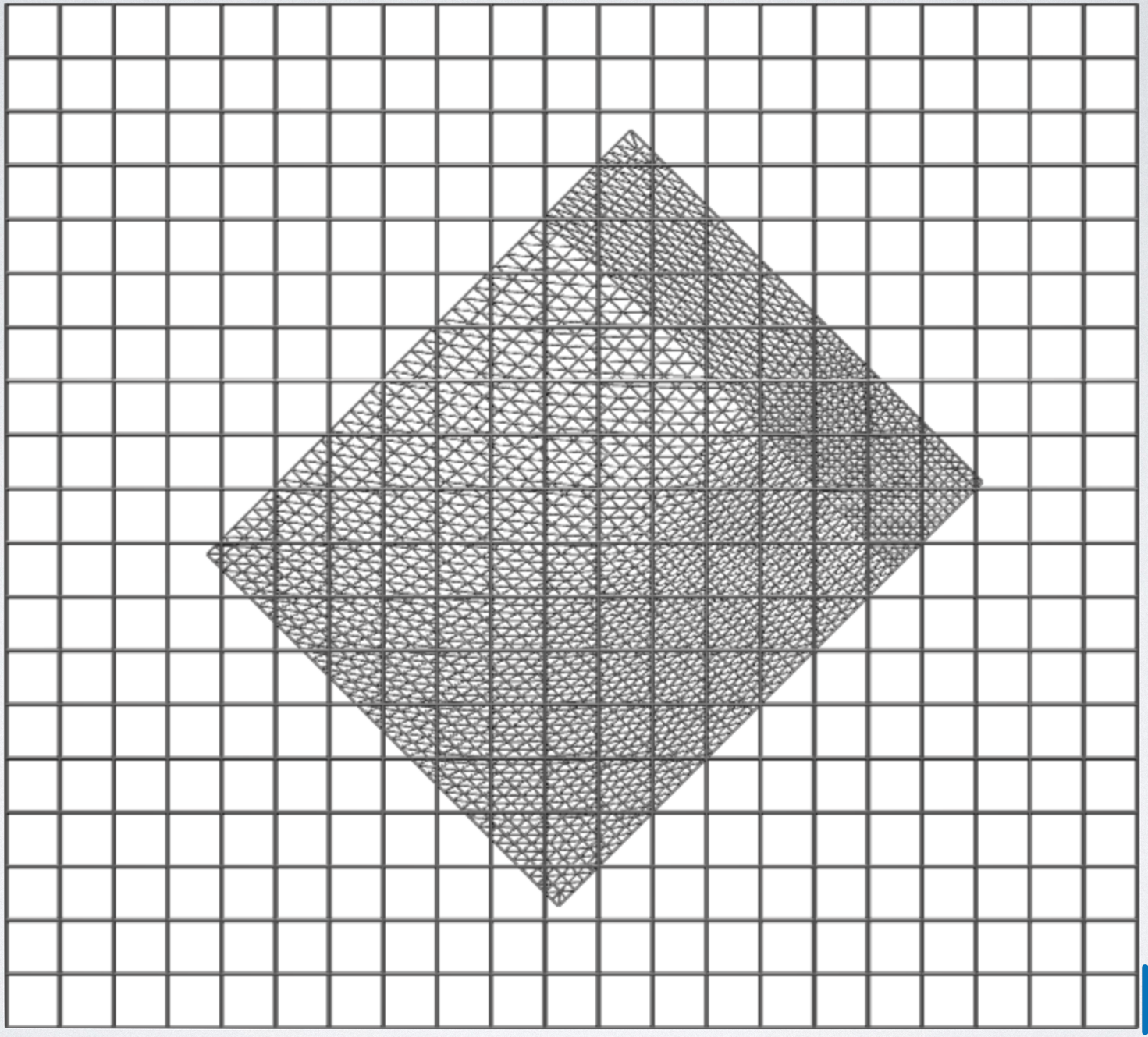


Boundary Aligned Meshing

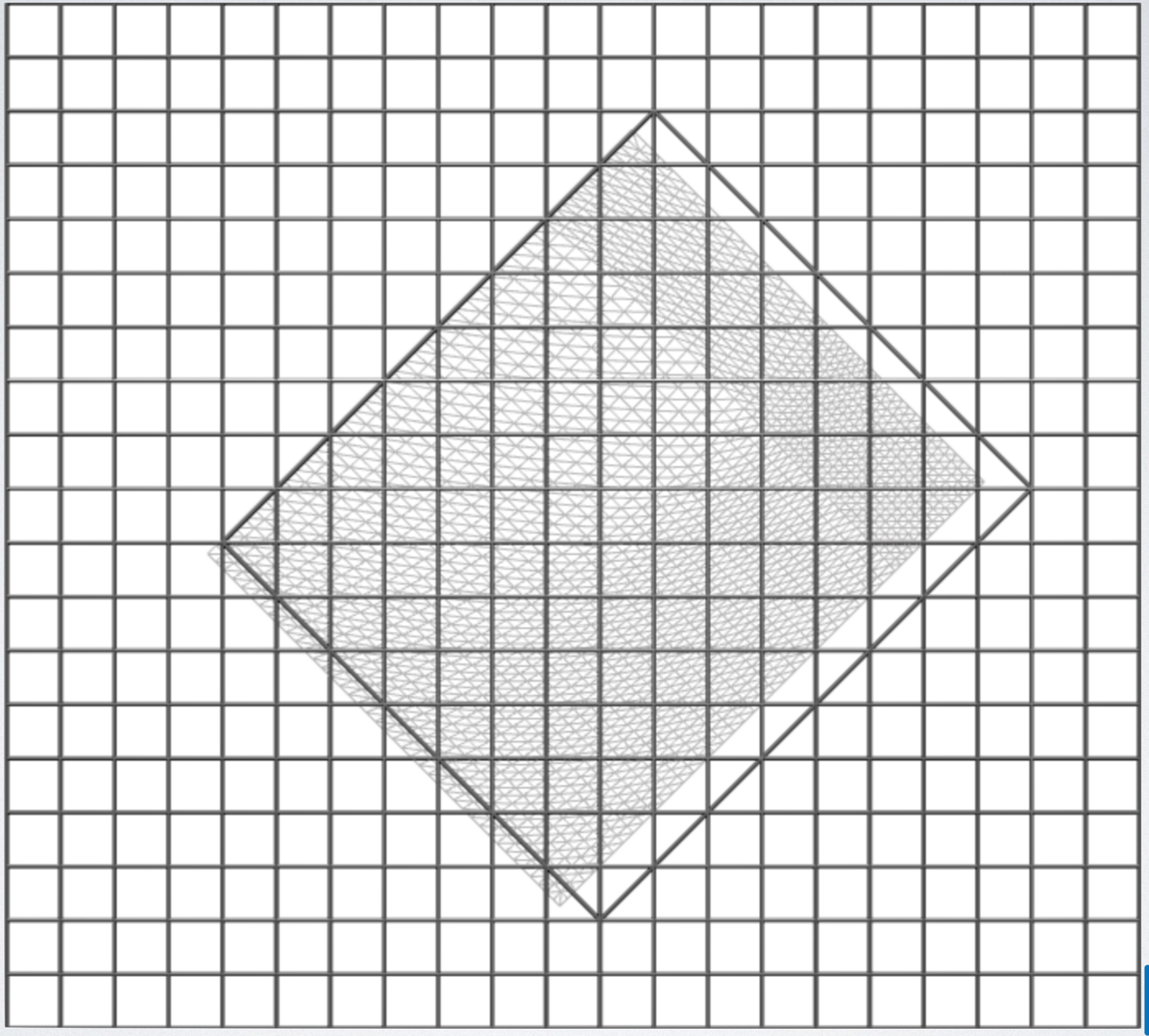




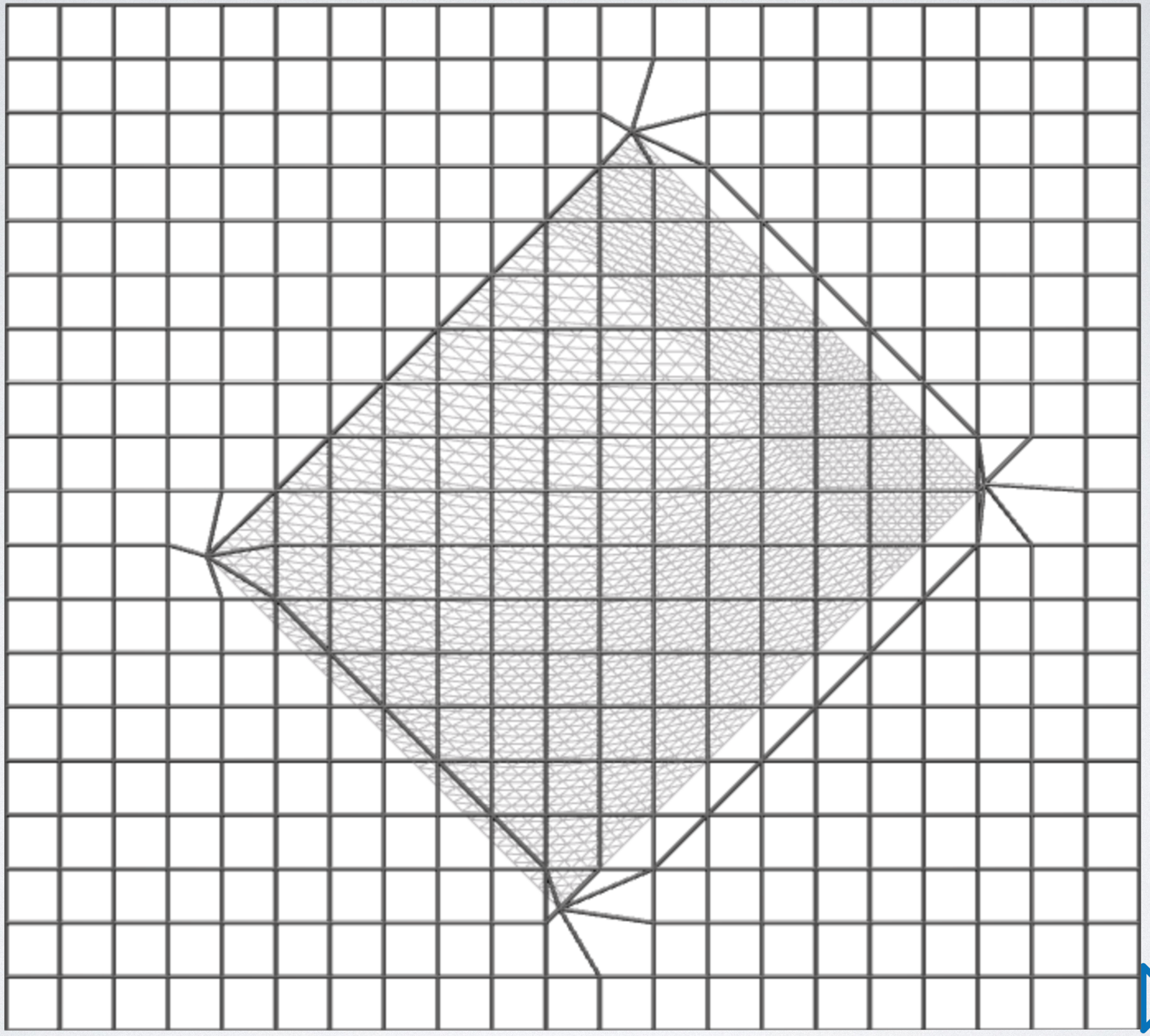
DGD | SFB TRR 109 | Discretization in Geometry and Dynamics



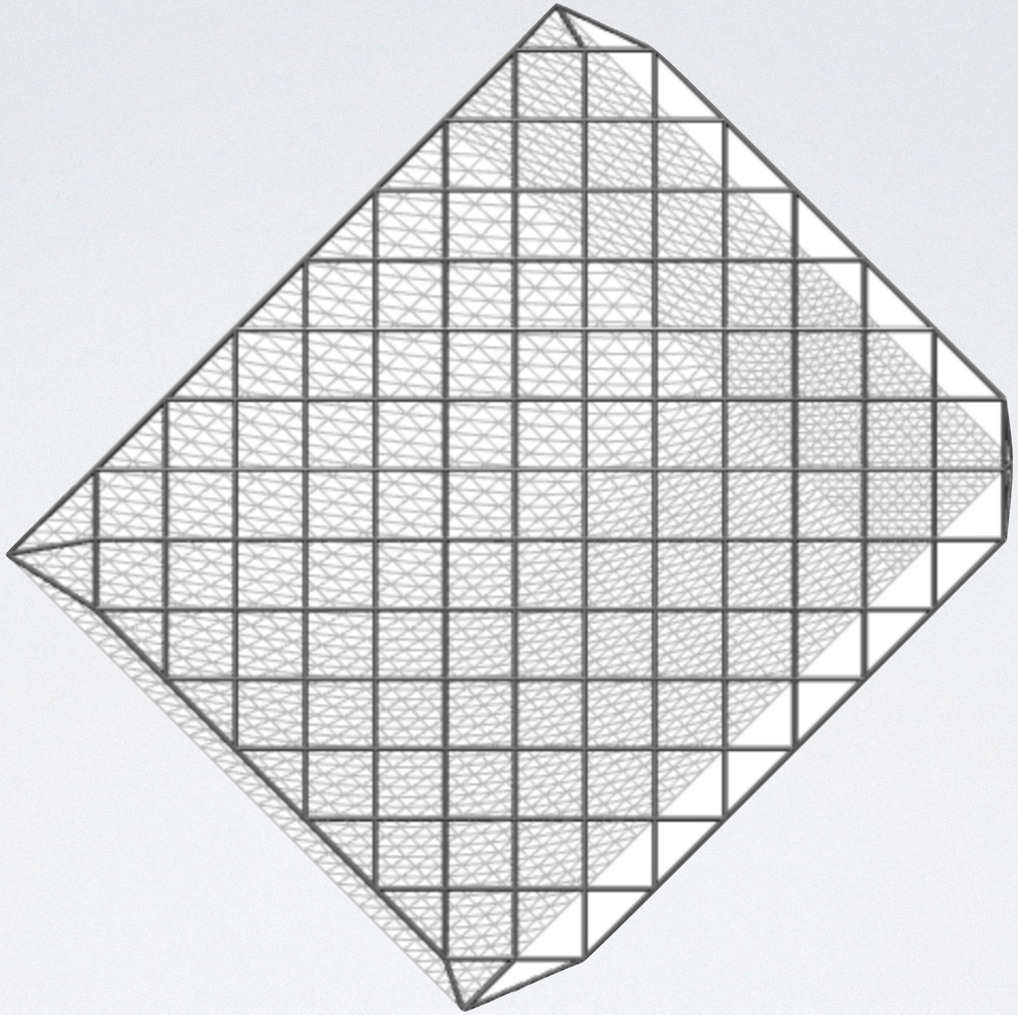
SFB TRR 109 | Discretization in Geometry and Dynamics

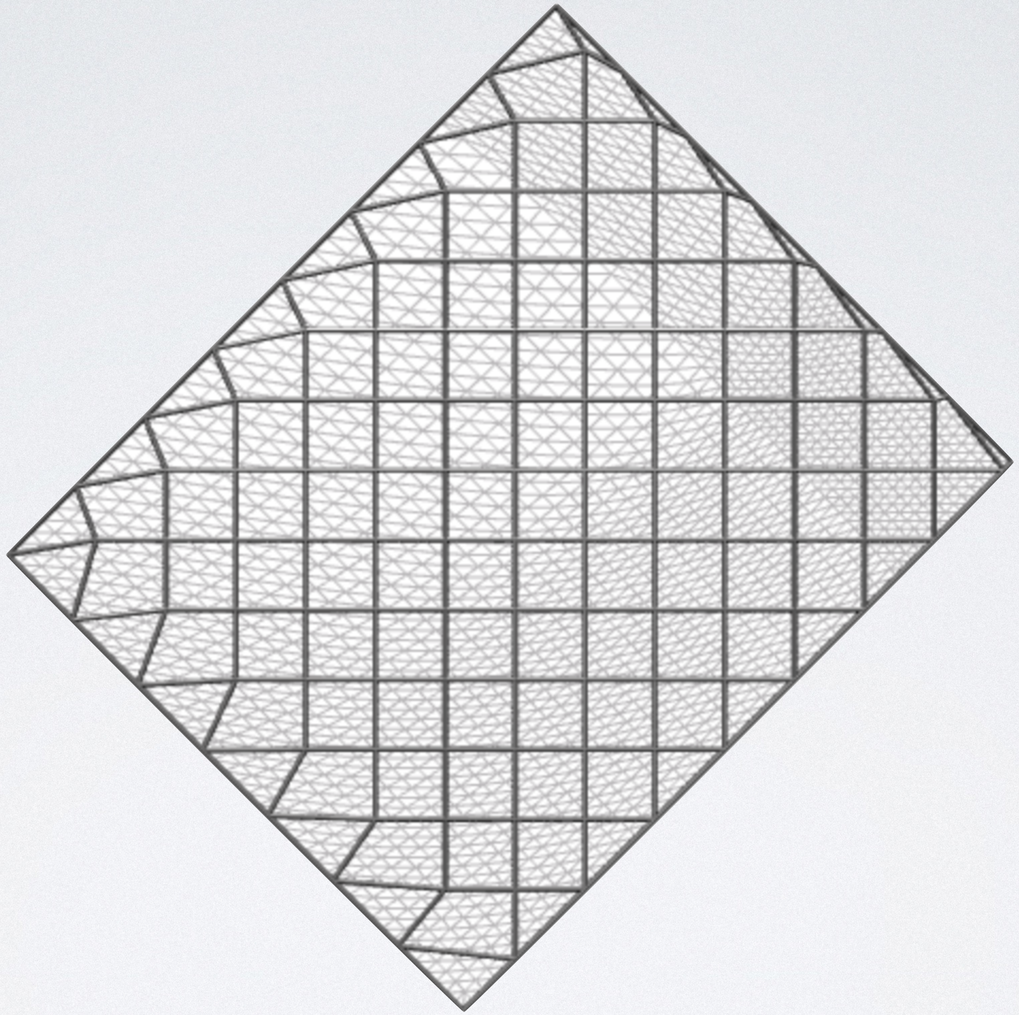


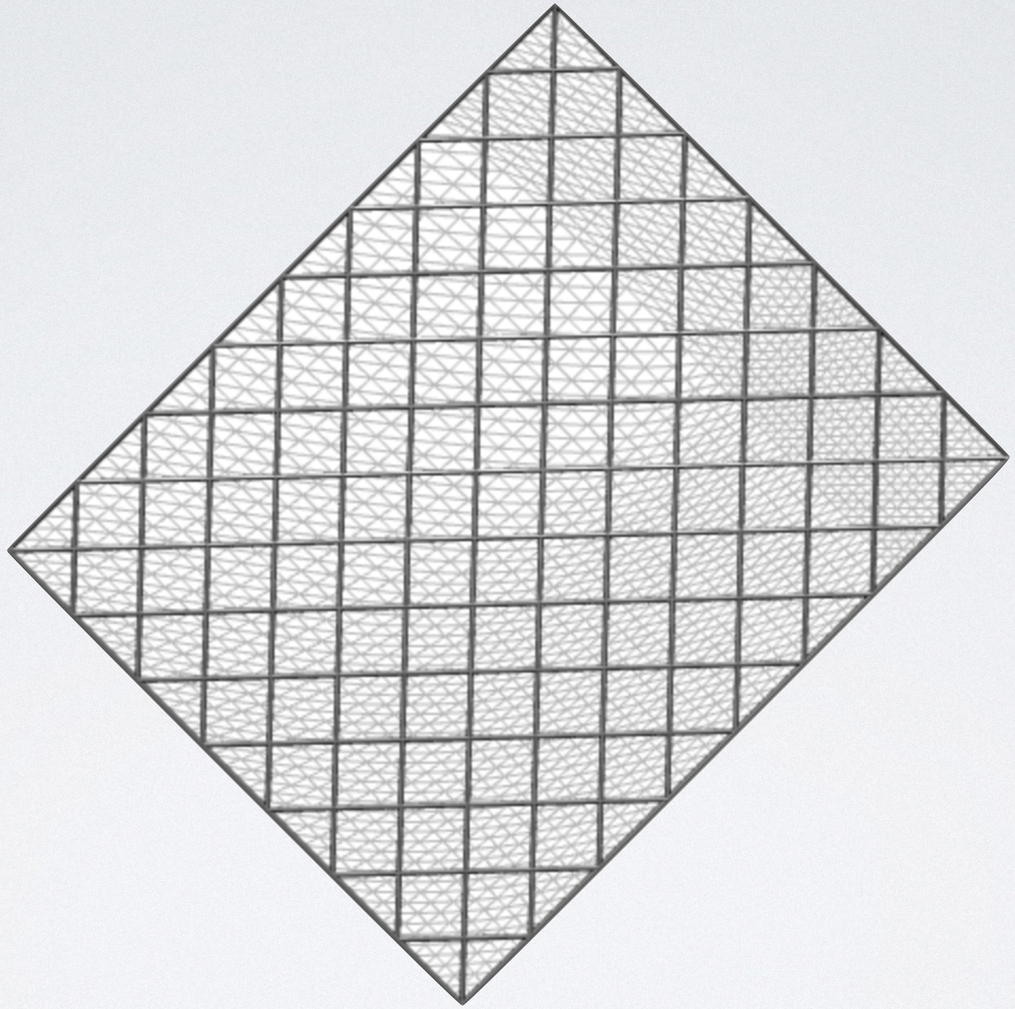
SFB TRR 109 | Discretization in Geometry and Dynamics



SFB TRR 109 | Discretization in Geometry and Dynamics



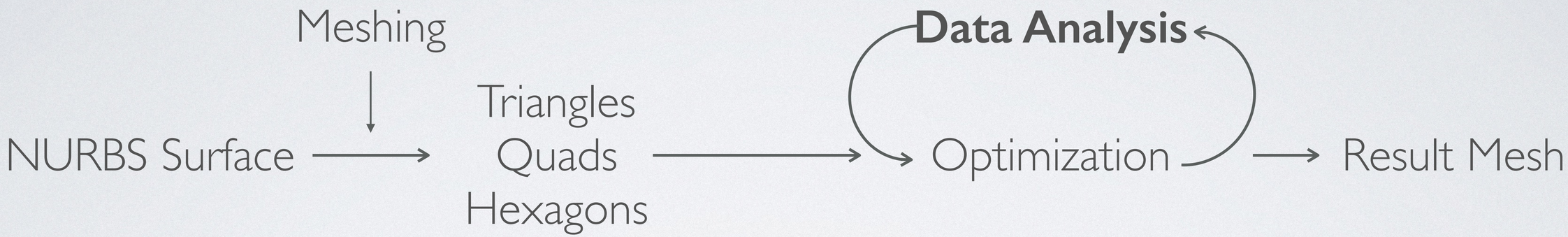


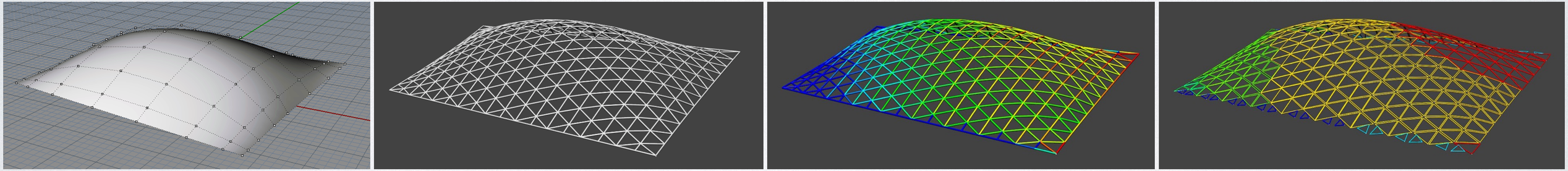


SFB TRR 109 | Discretization in Geometry and Dynamics

Meshing Demo

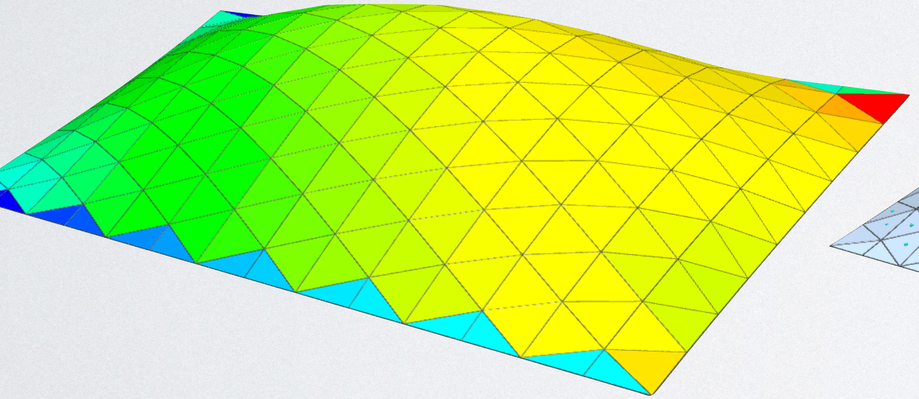
Discrete Surface Optimization



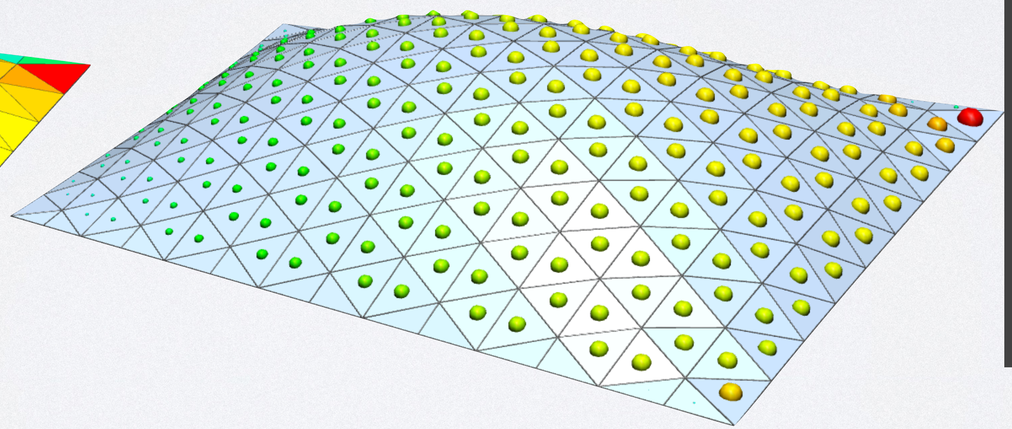


Mesh Data Visualization

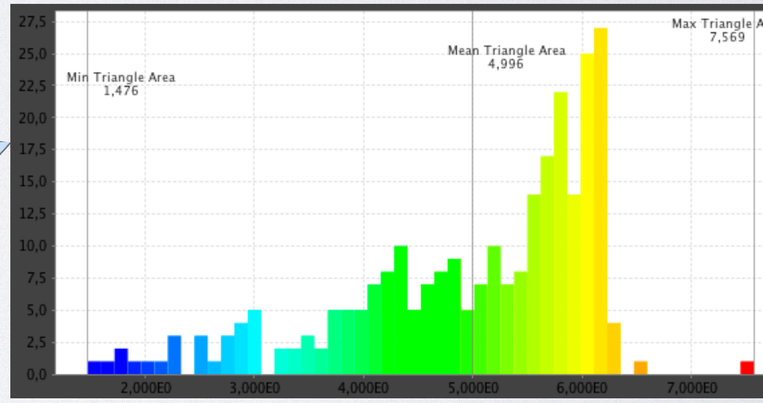
Colors



Spheres



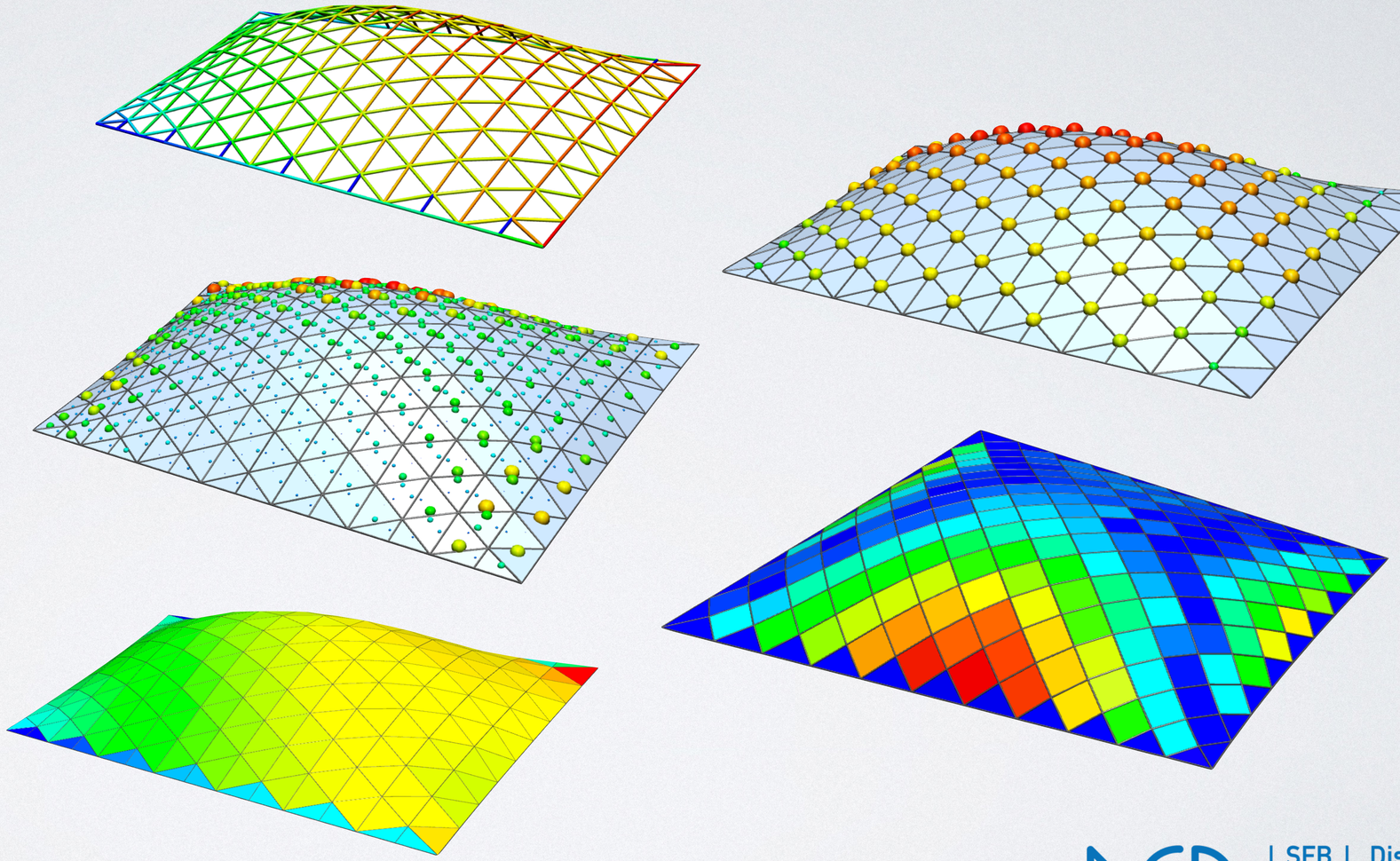
Histogram



DGD | SFB TRR 109 | Discretization in Geometry and Dynamics

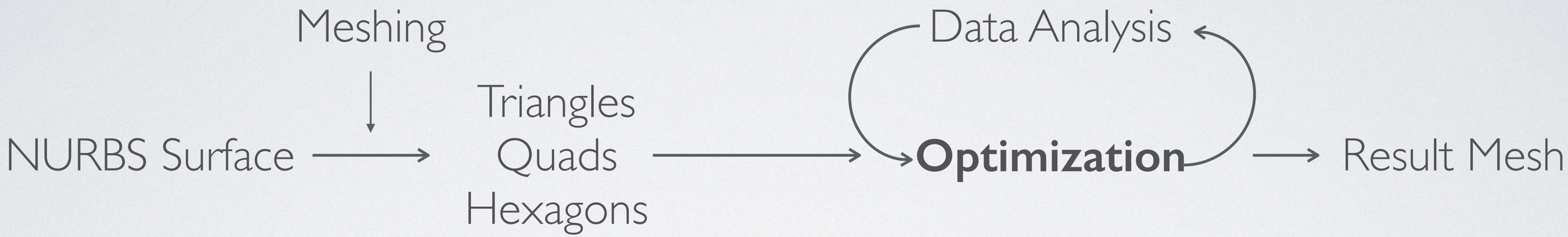
Build-In Data Sources

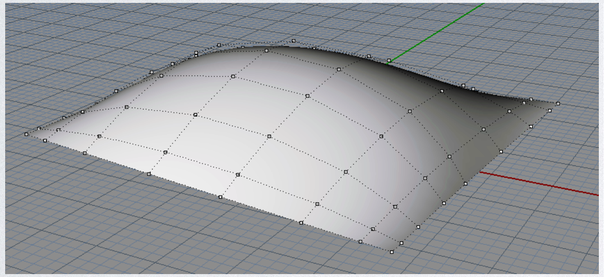
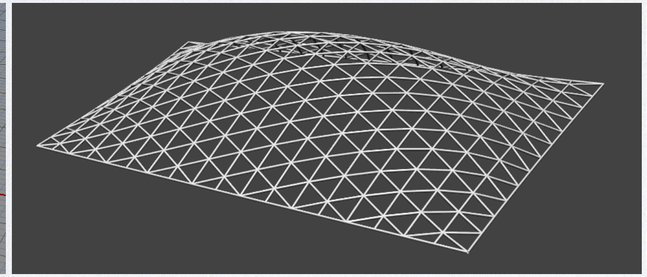
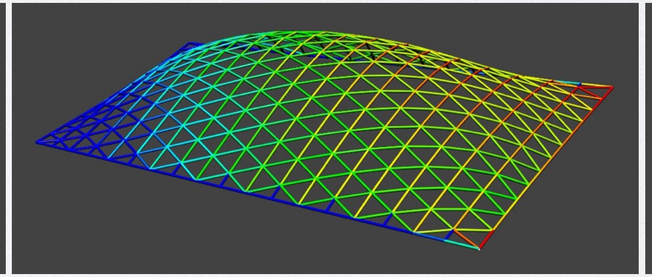
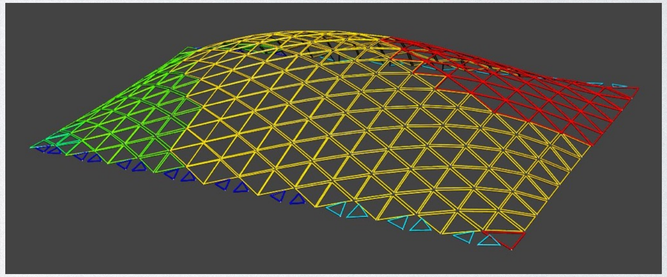
- Edge Length
- Gauss Curvature
- Edge Curvatures
- Face Planarity
- Triangle Area
- …



Visualization Demo

Discrete Surface Optimization

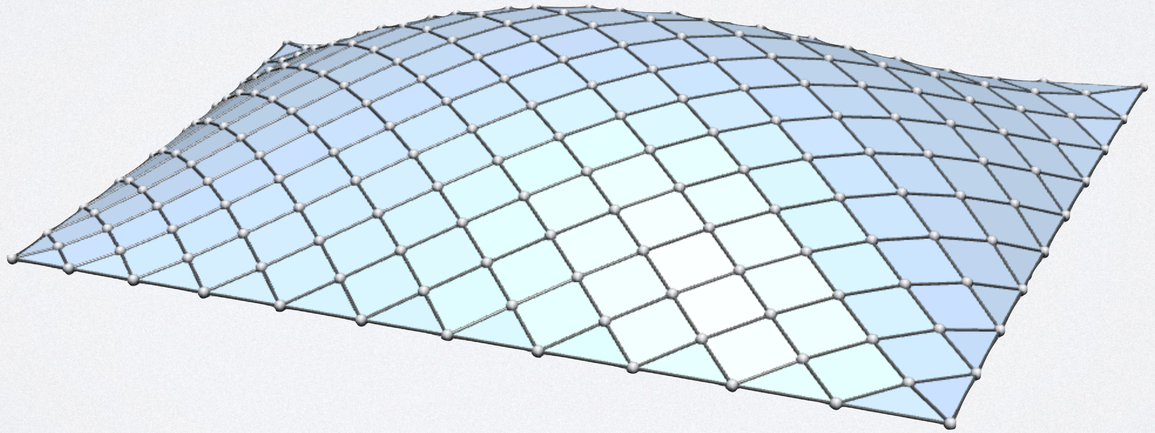


Mesh Optimization

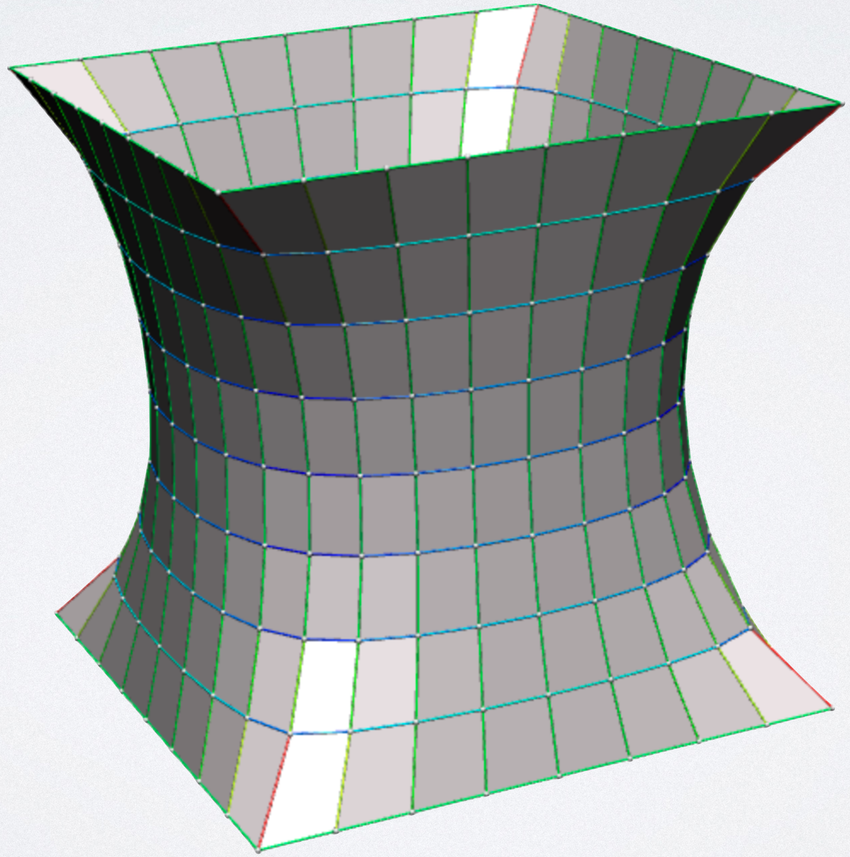
$$f_1, \ldots, f_n : S \to \mathbb{R}$$

$$f(S) = \sum_{i=1}^{n} \lambda_i f_i(S) \qquad \nabla f(S) = \sum_{i=1}^{n} \lambda_i \nabla f_i(S)$$



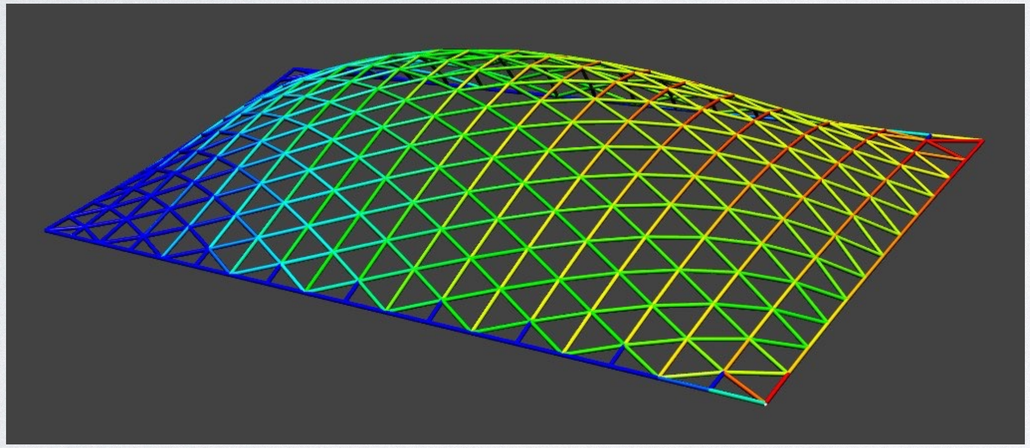
Springs Demo

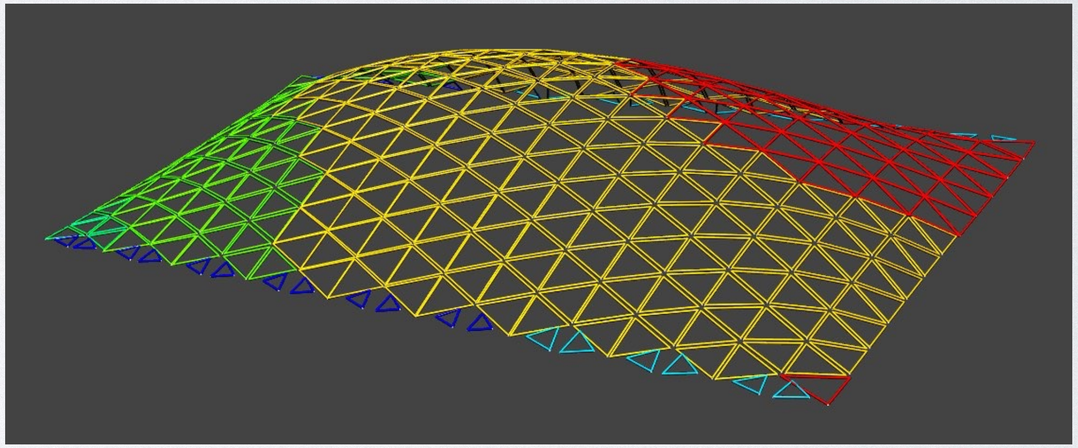
$$E_{spring} = \sum_{e_{ij} \in E} (\|v_i - v_j\| - l)^2$$



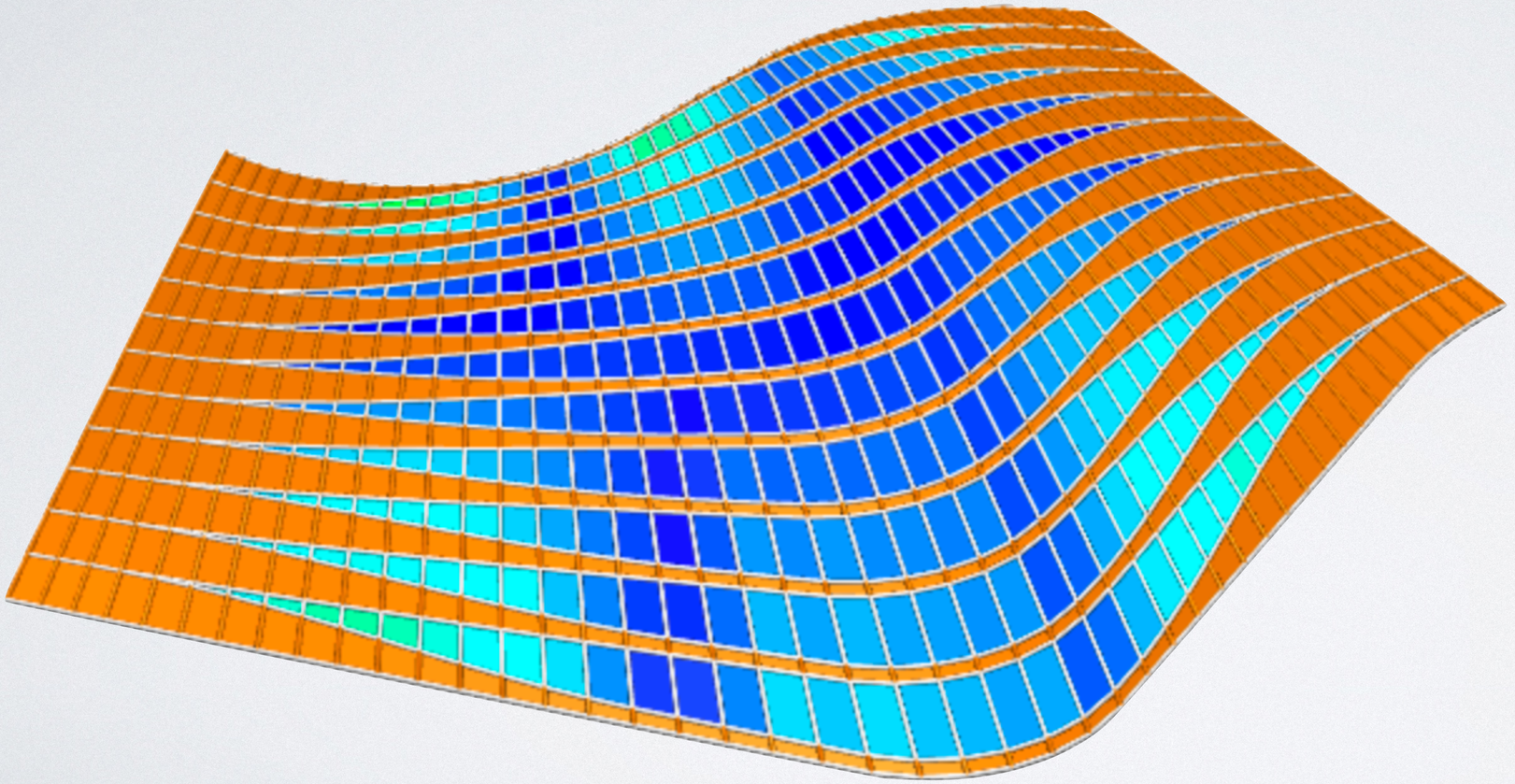
Quantized Edges

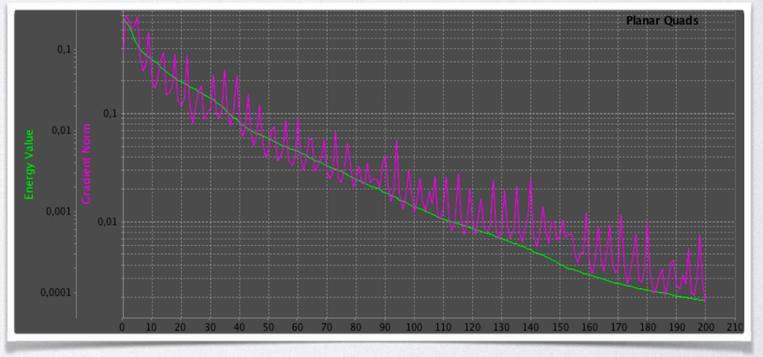
$$E_{spring} = \sum_{e_{ij} \in E} (\|v_i - v_j\| - l)^2$$





Planarity Demo

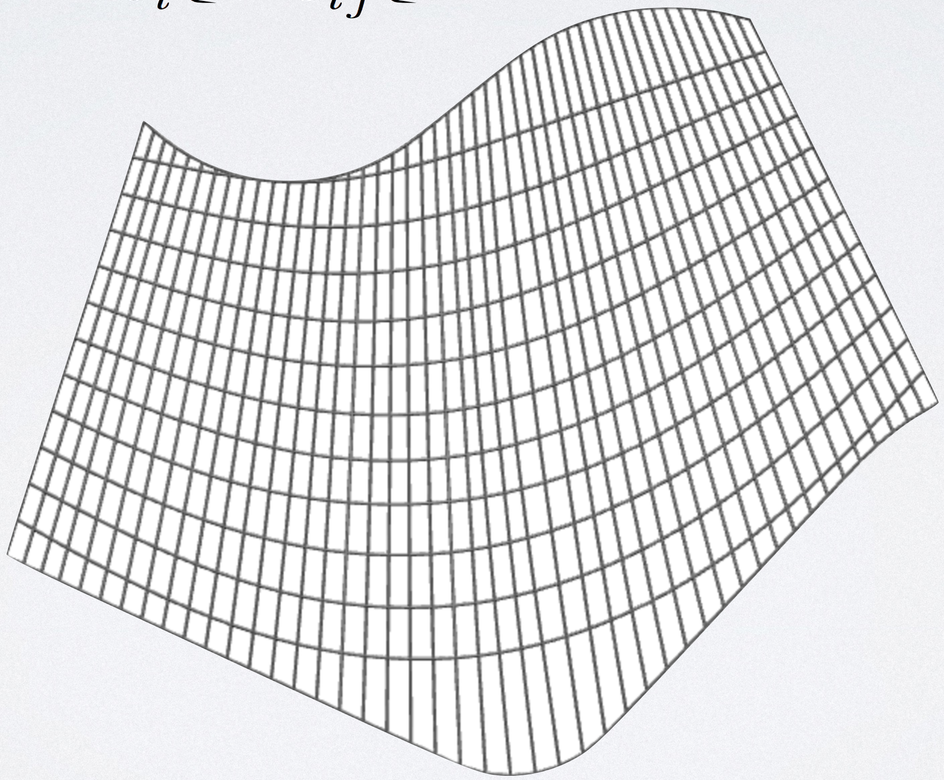




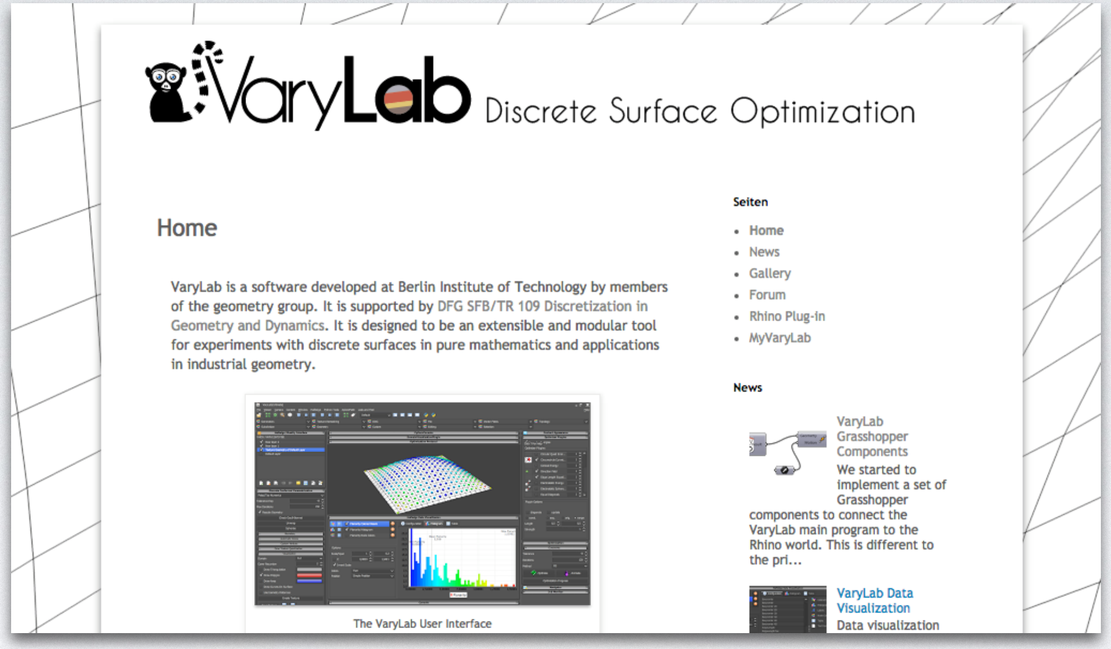
DGD | SFB TRR 109 | Discretization in Geometry and Dynamics

Fairing Demo

$$E_{ega} = \sum_{v_i \in V} \sum_{e_{ij} \in E} (\pi - \angle(e_{ij}, \tilde{e}_{ij}))^2$$



VaryLab and Grasshopper



WWW.VARYLAB.COM

SFB TRR 109 | Discretization in Geometry and Dynamics