Model Slicing and Support Structure Generation for 3d Printing

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Agenda

- Starting Point
- Architecture
- Implementation
  - Support Structur Generation
  - Slicing
  - Adaptive Mesh

Starting Point

- Many nice tools of libraries, but none suitable.
  (pythonOCC, Meshlab, libcarve, netfabb, FreeCAD)
- Slicing software like Skeinfrogde and Slic3r are very complex.
- Own C++ raytracer implementation.

Architecture

- import model; build KD-tree.
- Generate support structure.
- slice model; build contours.
- fill contours with an adaptive grid.

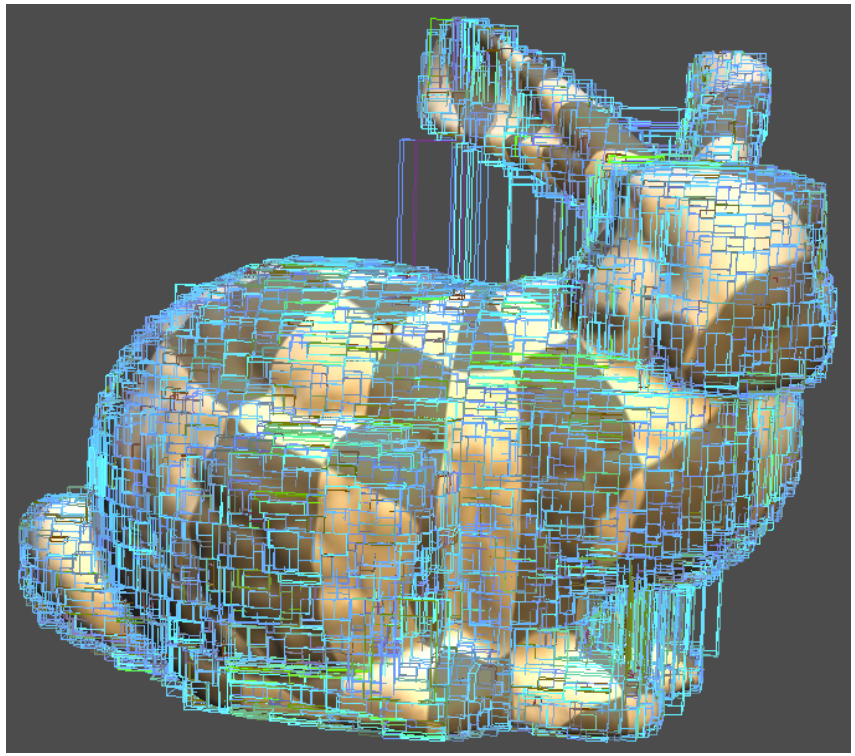

Figure: Last level of the KD-tree.

Support Structur Generation

- Mark triangles faceing steep “down”.
- Obtain the contour of this surface.
- Projekt onto the model and the base plane.
- Build the support volume from support and projection surface.
- Use the KD tree representation for slicing.

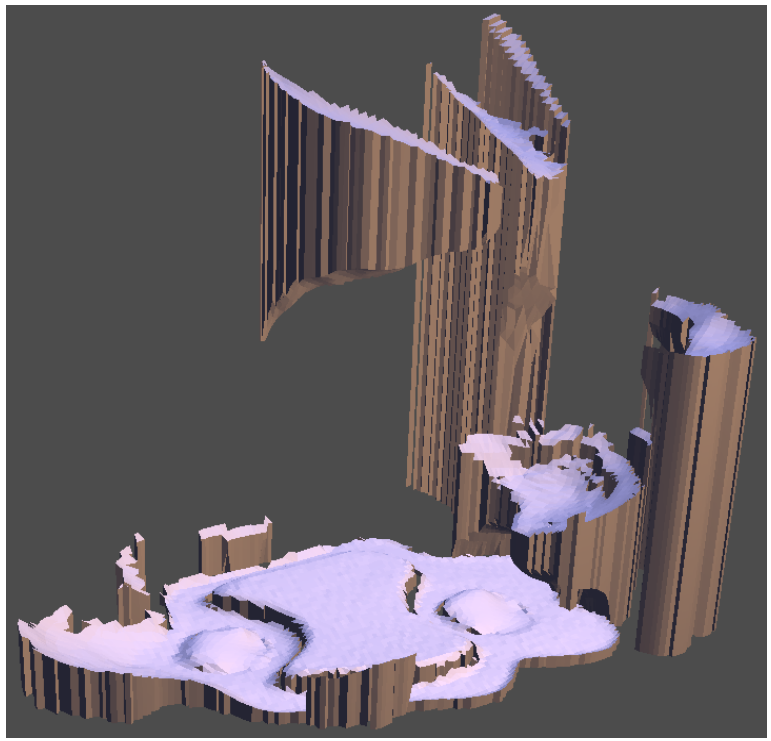

Figure: Support volume for the Stanford Bunny.

Slicing

- Intersect model and support KD tree with the slicing plane
- Build contour set form edges.

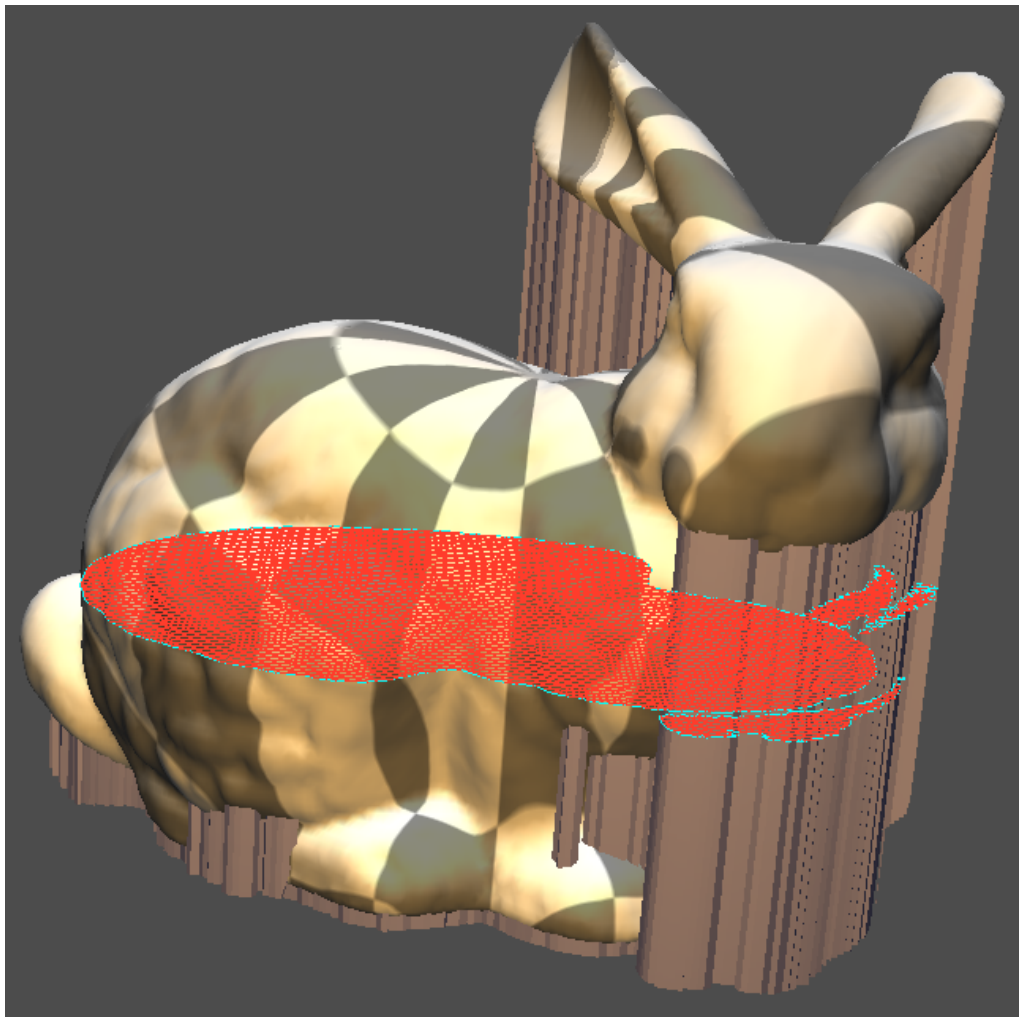

Figure: Slice through the model

Adaptive Mesh

- Grid layout is defined by a set of planes.
- Planes are translated along their normal to generate different lines.
- Translation step decides on grid density
- $ds = ds_{max} \cdot \left(1 - \frac{h_{max}}{h_{lineavg}}\right)$
  h : model height; ds : translation step

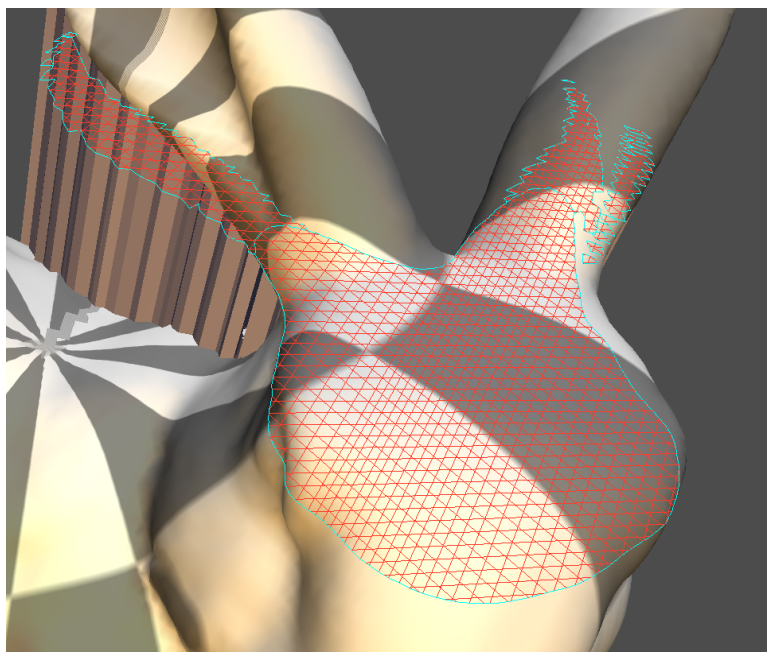

Figure: Adaptive grid density