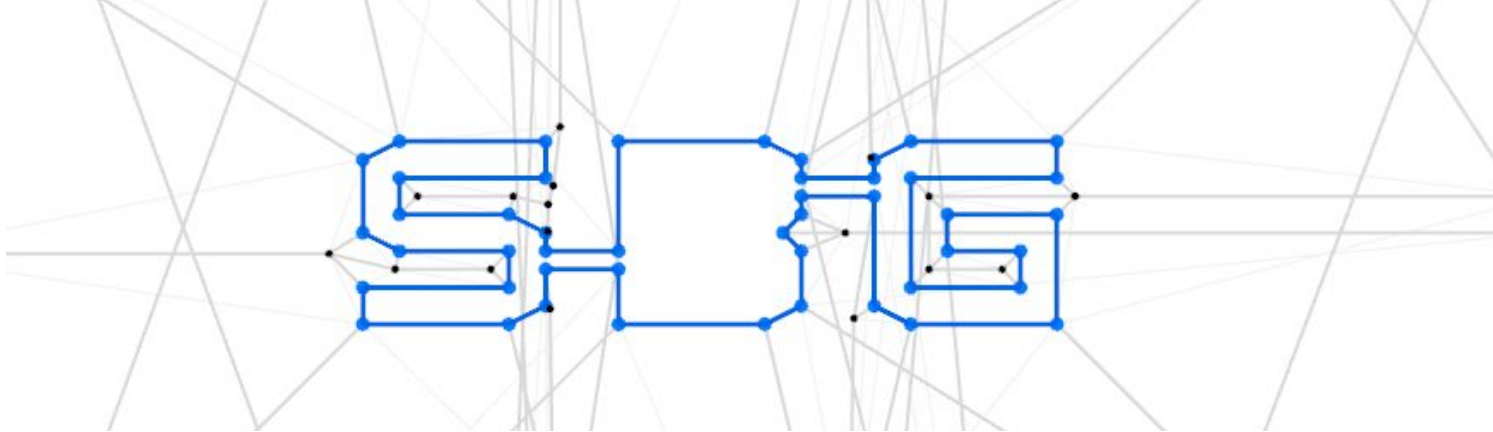


Extended slopes

Artem Amirkhanov @ SBG Användarträff 2018

artem.amirkhanov@leica-geosystems.com



~~Extended~~ slippery slopes

Artem Amirkhanov @ SBG Användarträff 2018

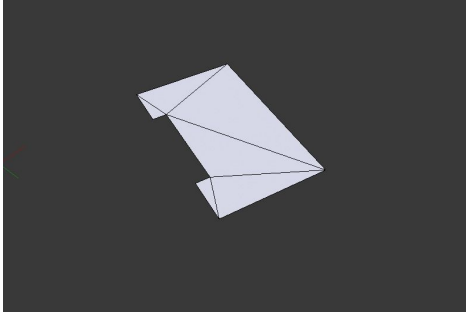
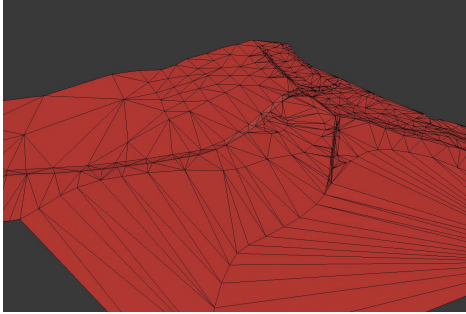
artem.amirkhanov@leica-geosystems.com

Goals

- Follow through the algorithm design process
- Demonstrate challenges and hidden complexity
- Discuss advantages and limitations of implementation

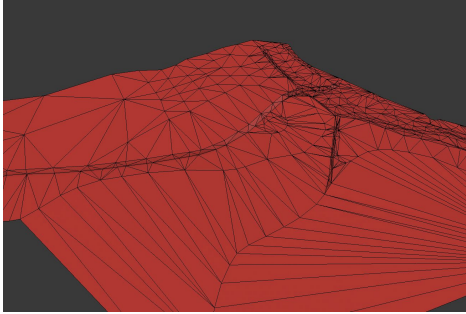
What is extended slope?

Input

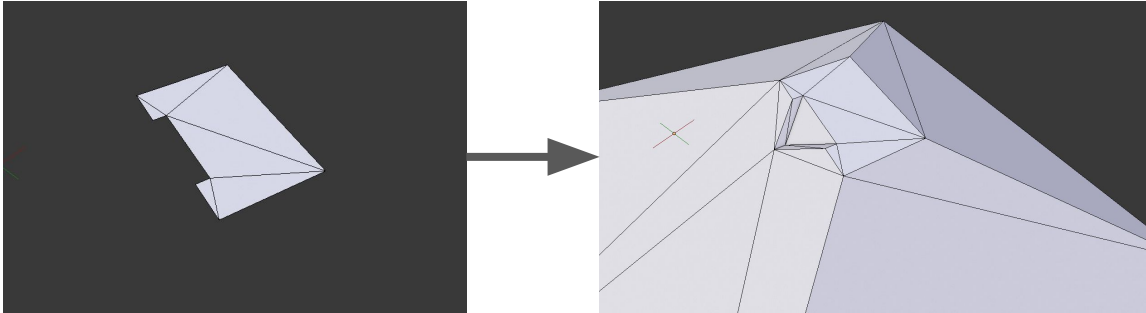


What is extended slope?

Input

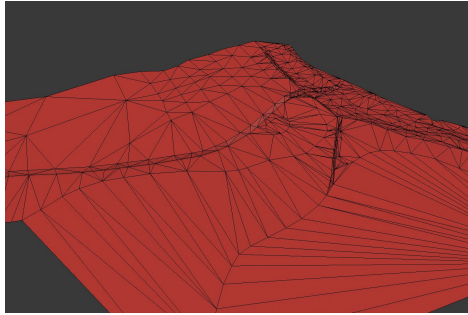


Slope

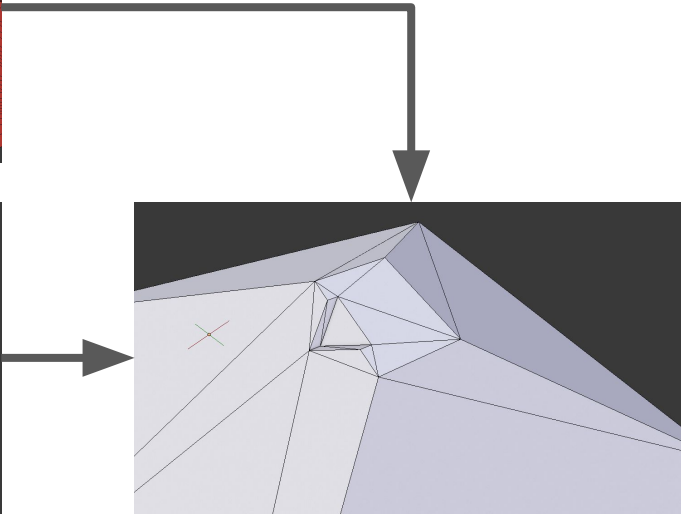
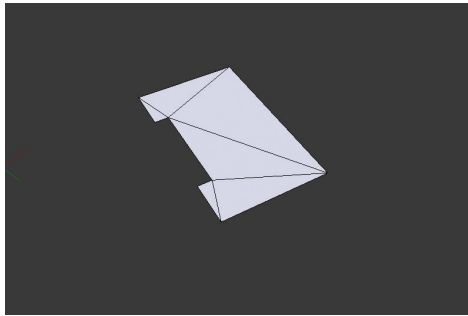


What is extended slope?

Input

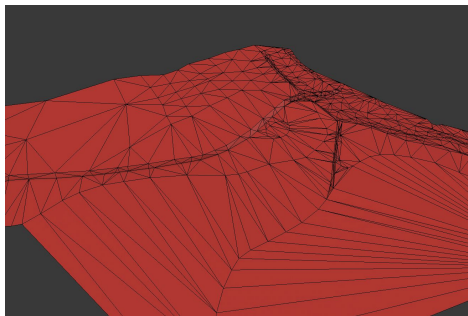


Slope

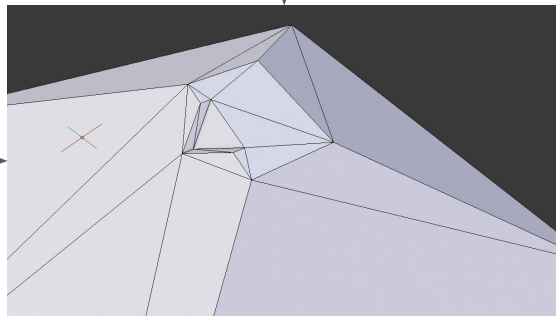
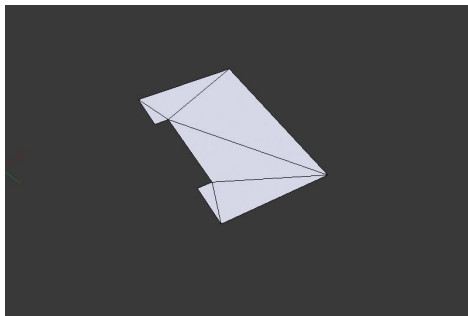


What is extended slope?

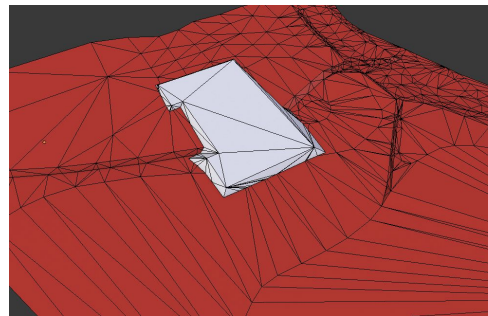
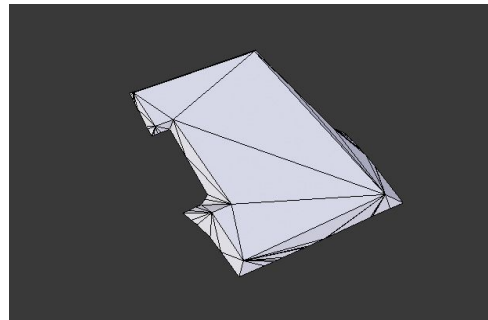
Input



Slope



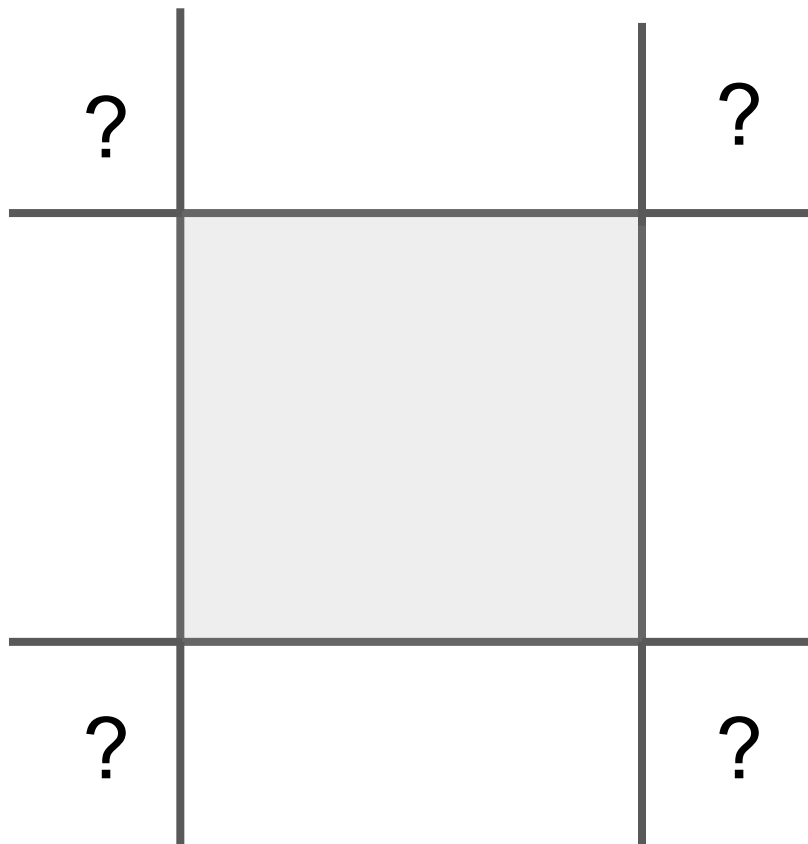
Extended slope



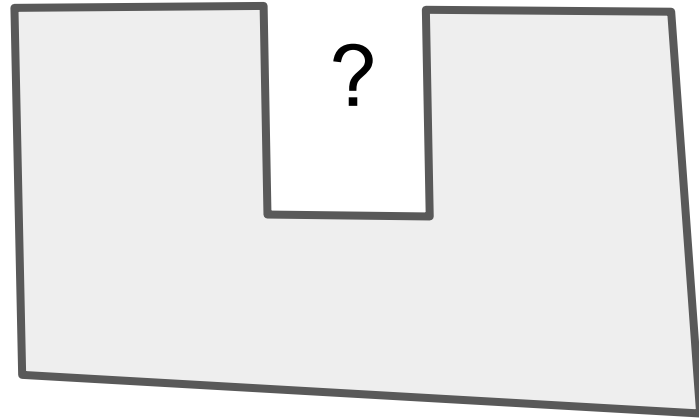
It's that simple

It's that simple ... NOT

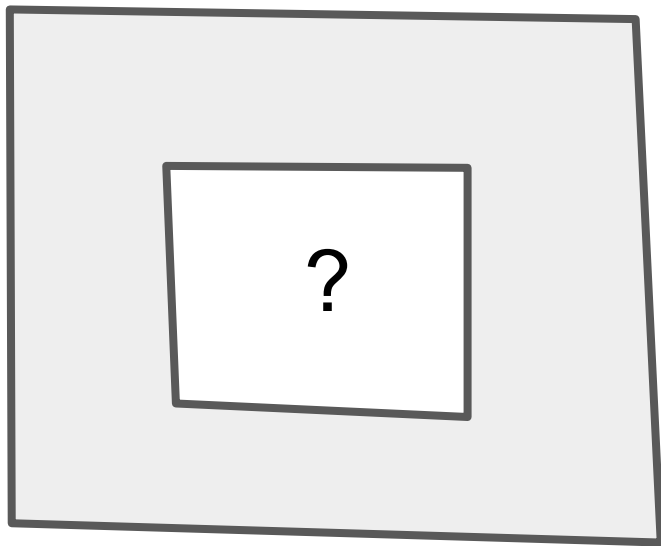
Slope in corners?



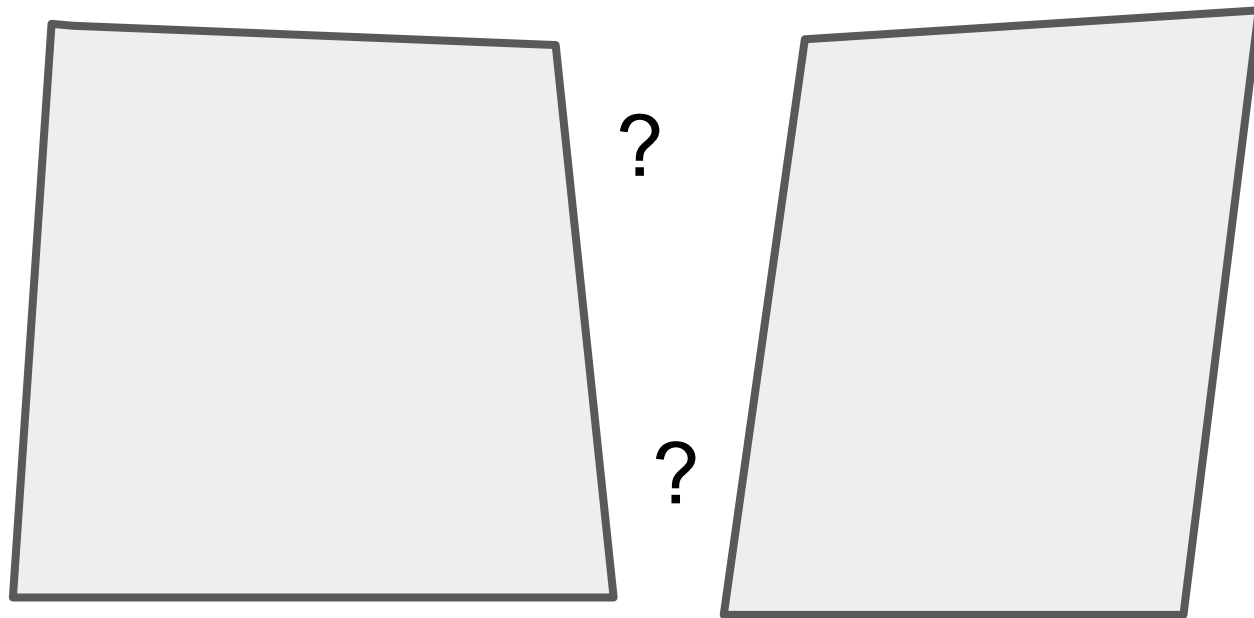
Non-convex boundaries?



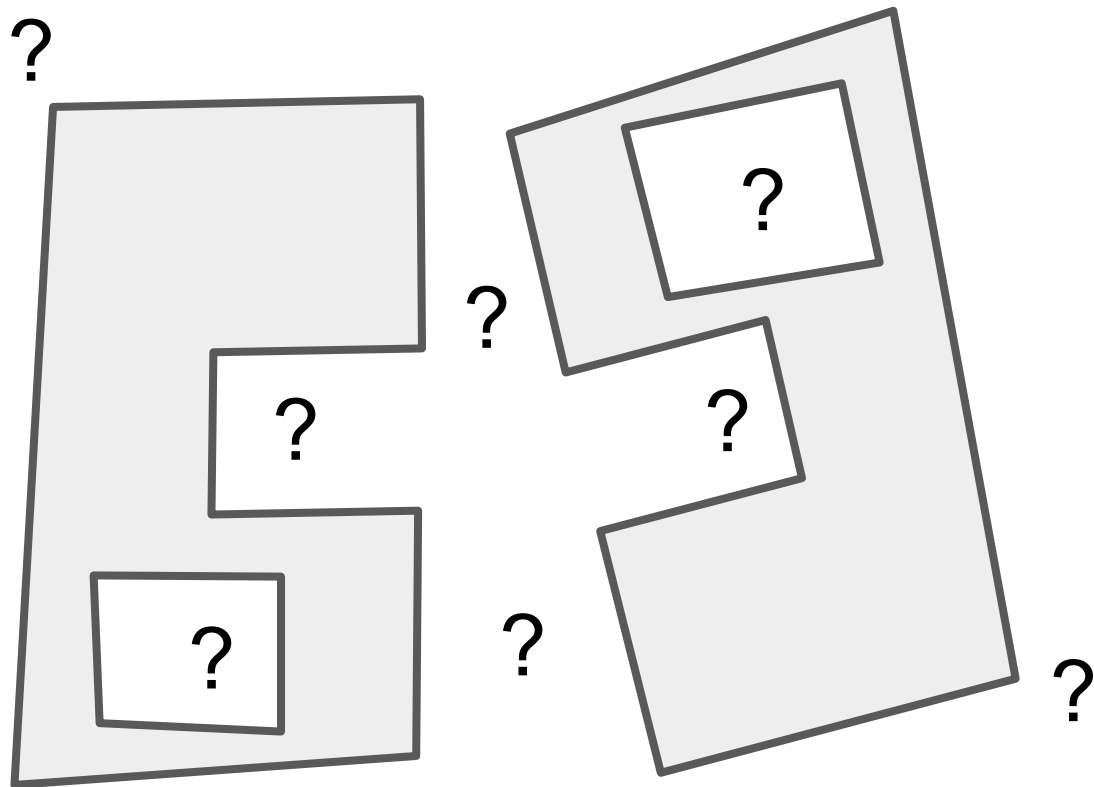
Holes?



Disjoint boundaries?



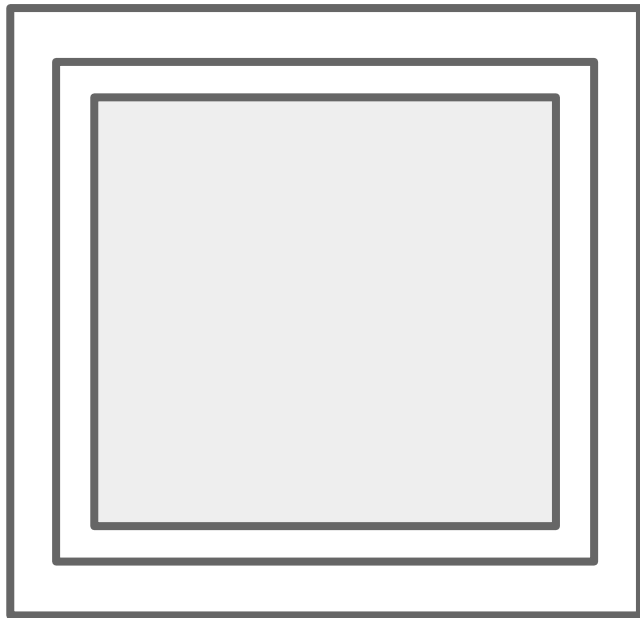
Disjoint non-convex boundaries with holes?





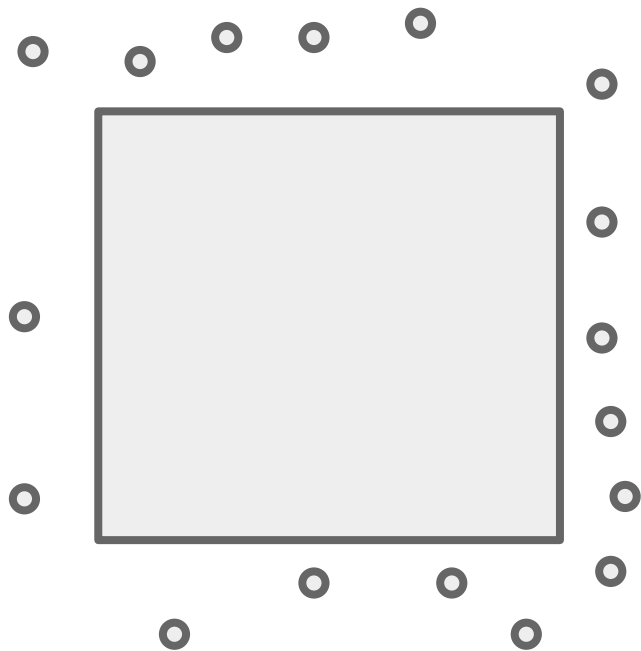
Some ideas for creating a slope

- Offset boundary step-by-step



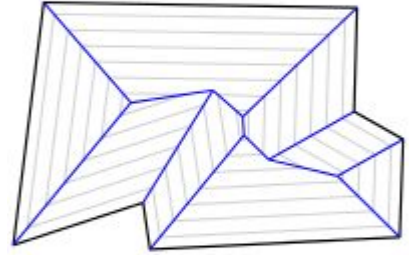
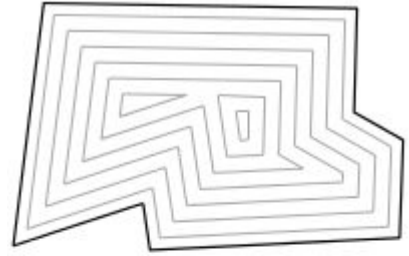
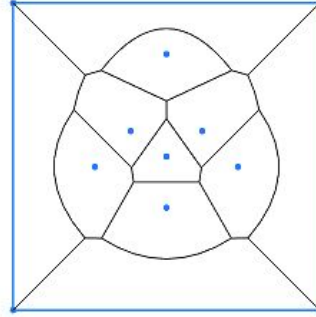
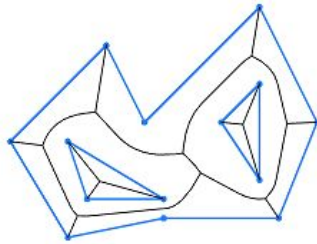
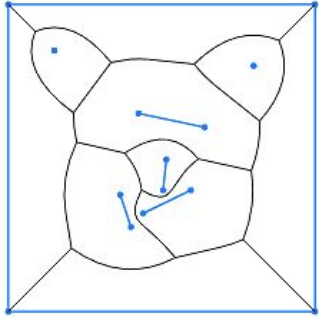
Some ideas for creating a slope

- Offset boundary step-by-step
- Seed points around model



Some ideas for creating a slope

- Offset boundary step-by-step
- Seed points around model
- Use existing computational geometry algorithm



Some ideas for creating a slope

- Offset boundary step-by-step
- Seed points around model
- Use existing computational geometry algorithm
- Implement custom algorithm

Attempt #1: use Voronoi diagrams

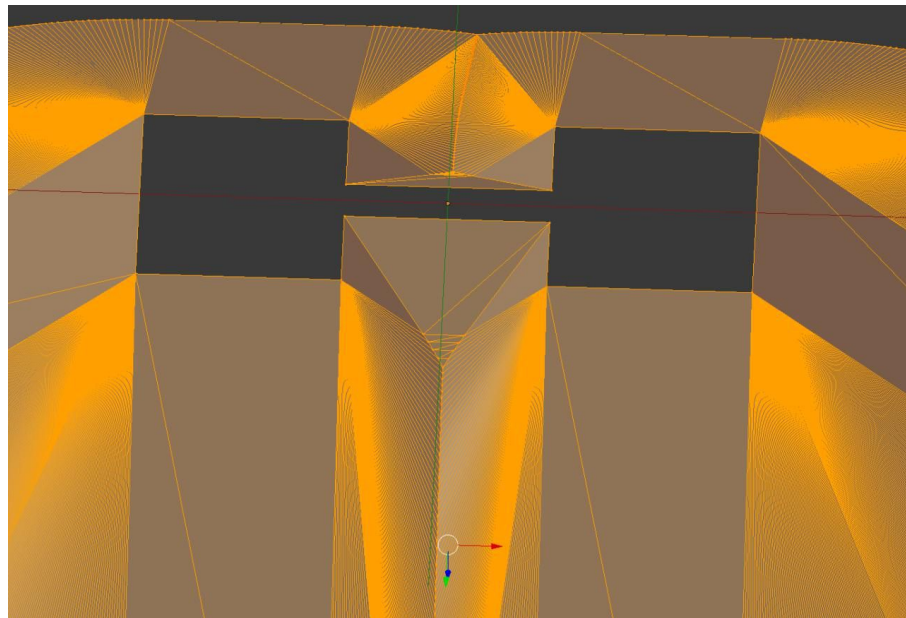
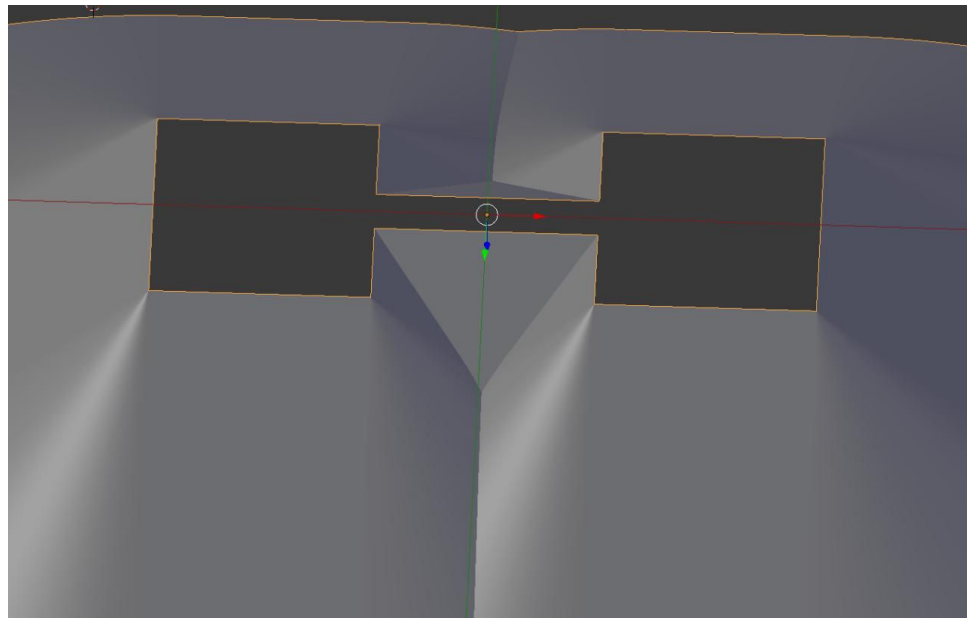
- Subdivide space into cells
 - Points in each cell are closest to one element (point/segment)
 - Only need to calculate heights
-
- Named after Georgy Voronoi
 - Dual problem to Delaunay triangulation



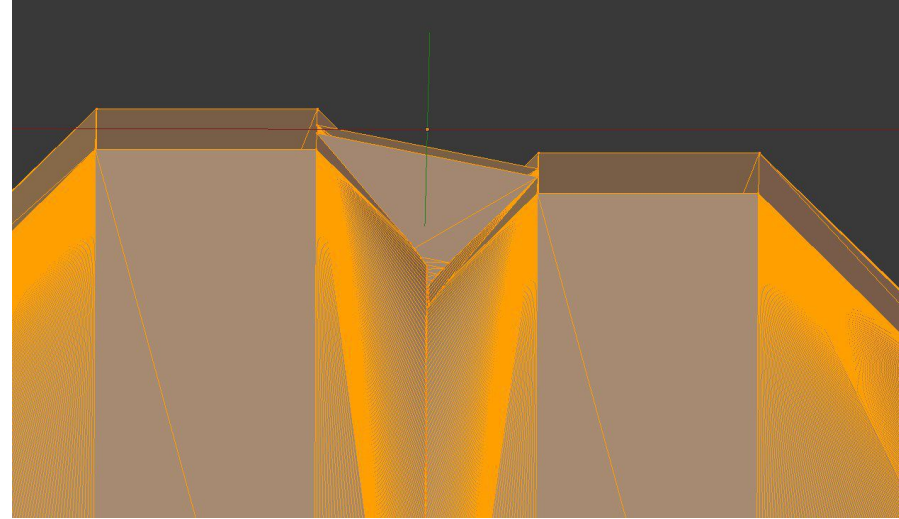
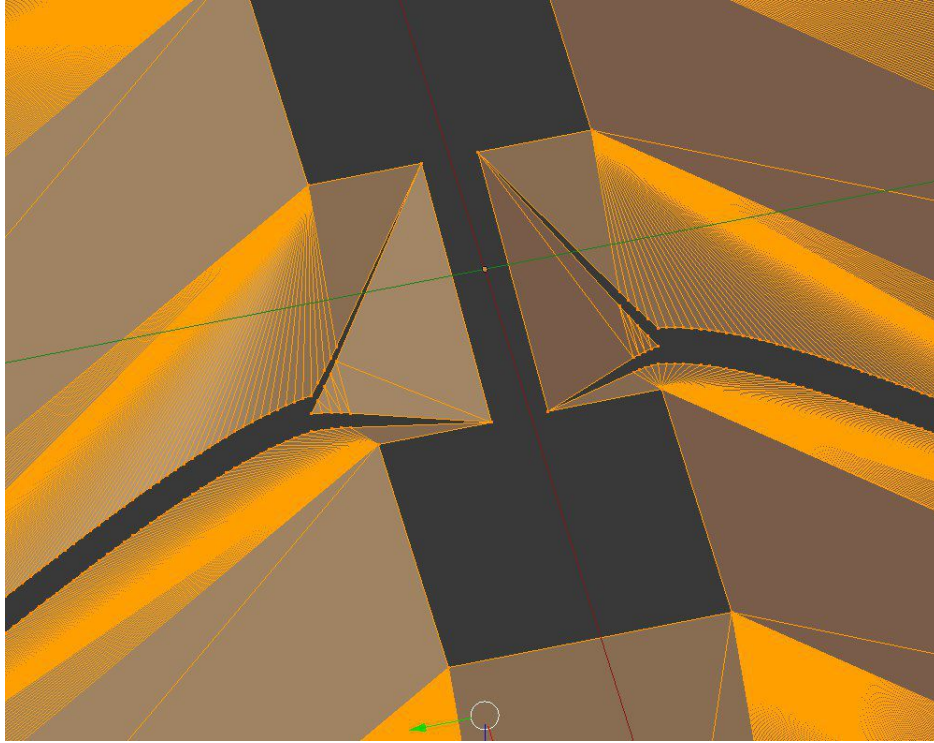
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Failed: trying to solve 3D problem in 2D



Failed: trying to solve 3D problem in 2D

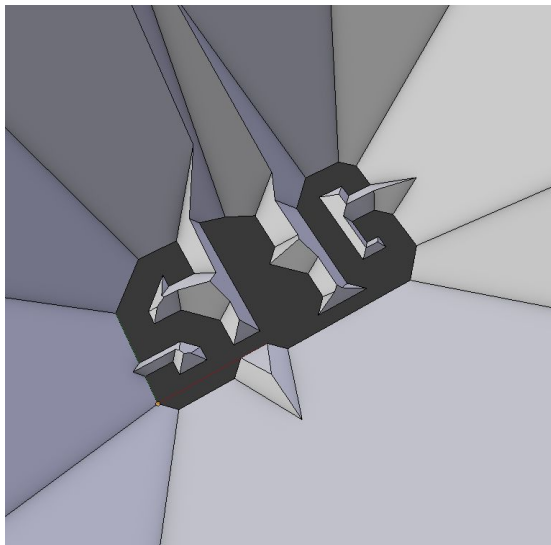
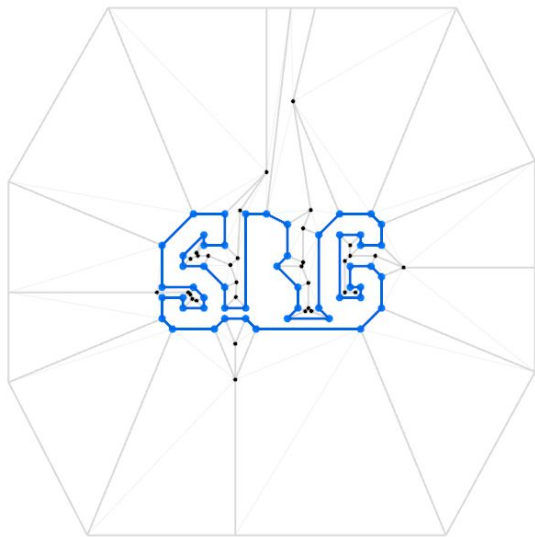


Attempt #2: custom algorithm

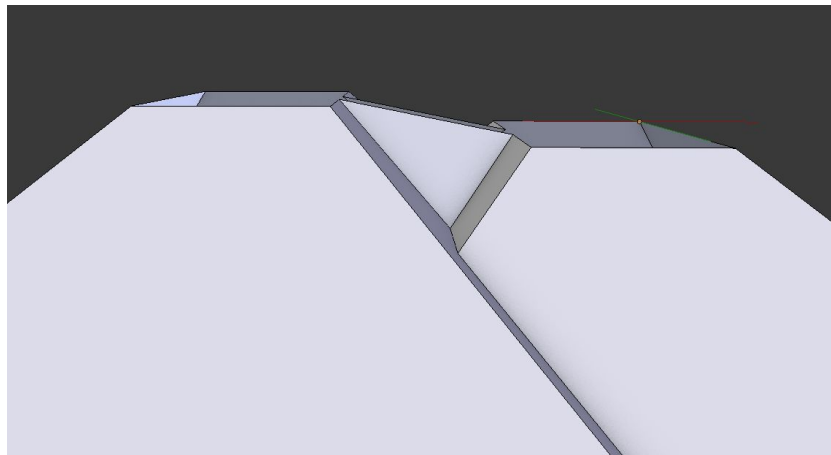
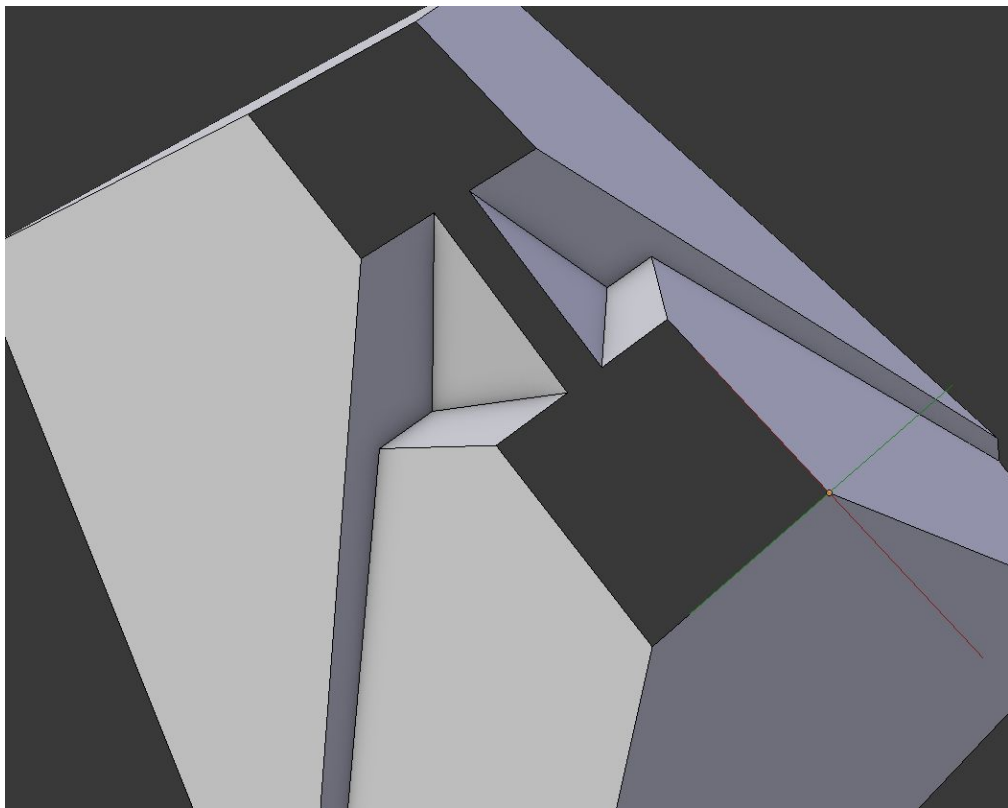
- After Voronoi disaster: looking for short-cuts
- But shortcuts did not cut it

Attempt #2: custom algorithm

- Build slope as a graph
(similar to Voronoi but works in 3D)
- Crop infinite edges
- Triangulate each graph cell

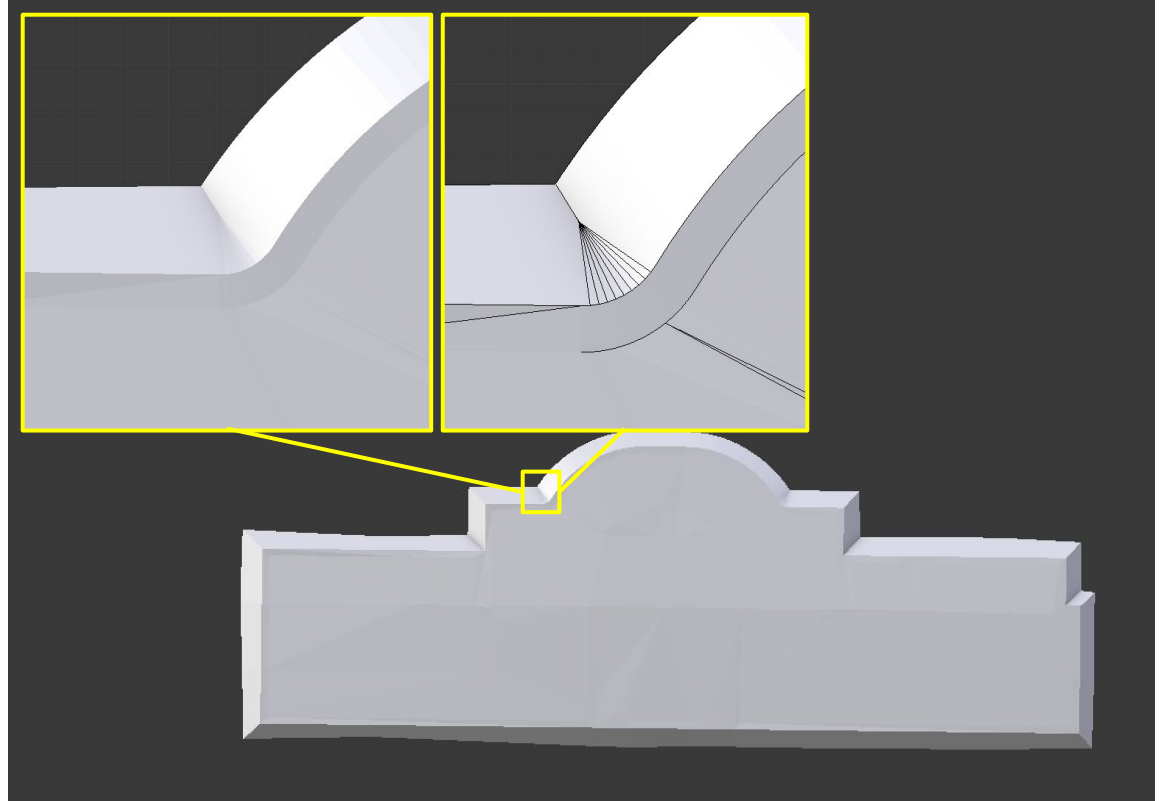


Works for 2.5D geometries



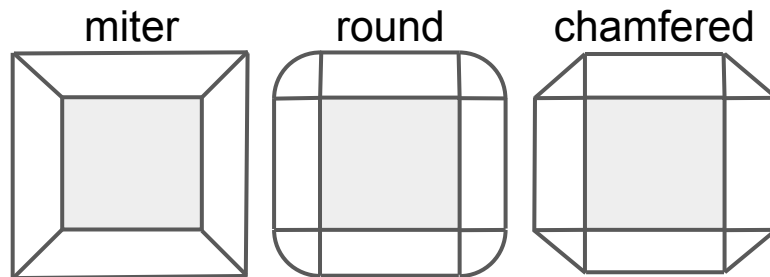
Handles merge points

- Less points/triangles
- Exact

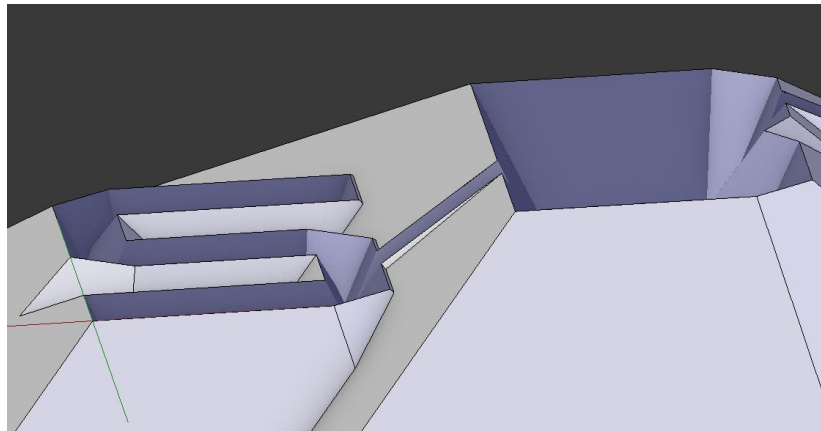


Other advantages and limitations

- Handles holes
- Implements miter corners
- Round and chamfered corners extensions are possible



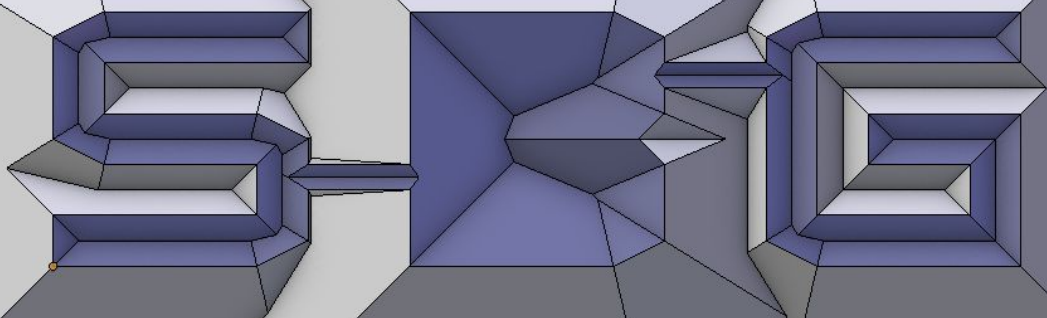
- Disjoint geometries not supported (but can be added)
- Fails with large height differences



Poll:

“Do you need extended slopes to support ... ?”

- Not flat geometries (2.5D)
- Non-convex boundaries
- Holes
- Round corners
- Chamfered corners
- Custom requests?



Thank you!

artem.amirkhanov@leica-geosystems.com