Papercraft Flatteners

- DXF 2 Papercraft
- Papercraft Unfold
- Paperfold

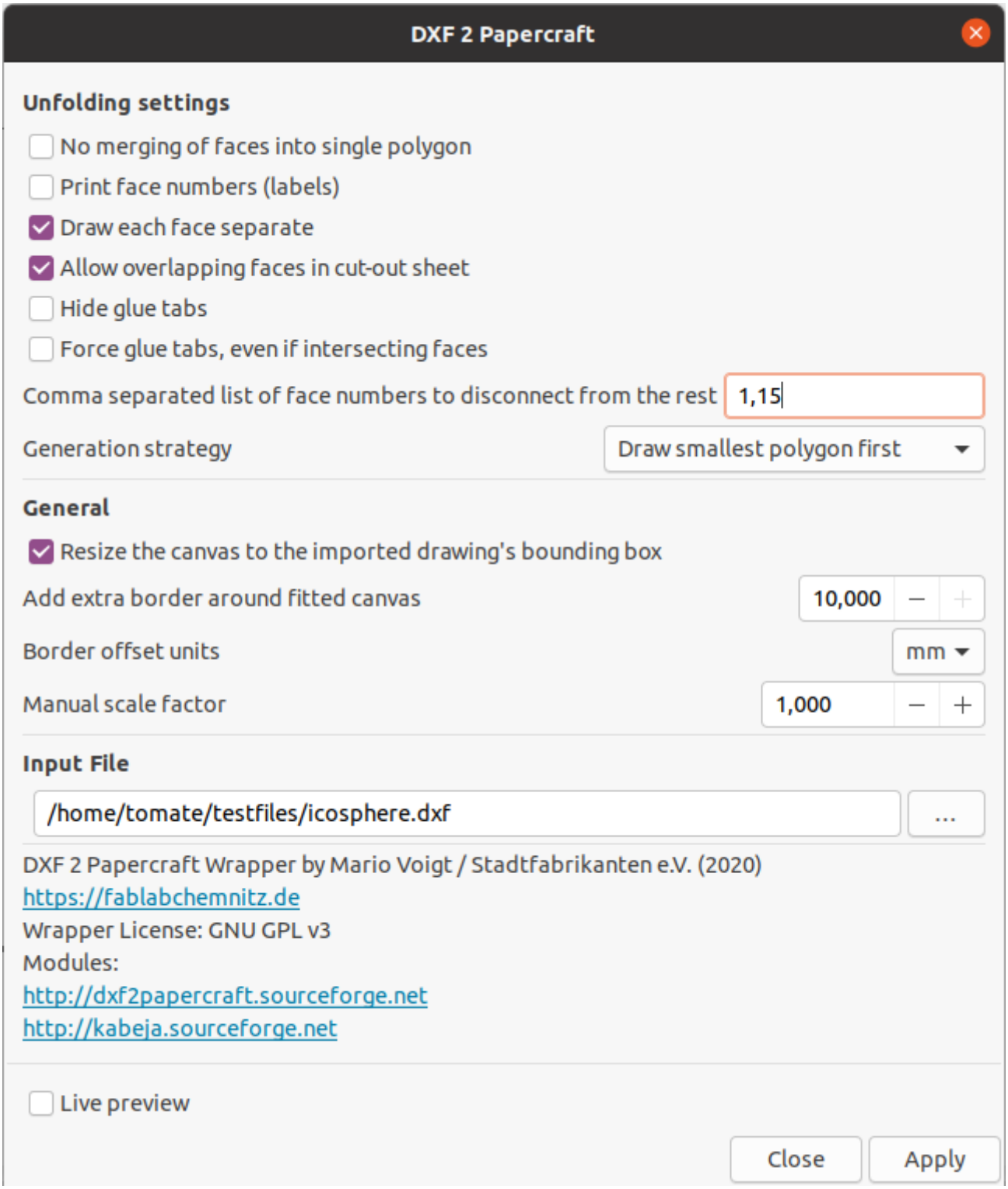
DXF 2 Papercraft

DXF 2 Papercraft is a small Inkscape wrapper for dxf2papercraft

Documentation page: https://dxf2papercraft.sourceforge.net

We can use Purge Duplicate Path Segments to remove duplicate lines to cleanup the generated output.

> Tested to work with DXF version "R12 Binary DXF". You can use ODA File Converter to convert down to this older format. See DXF/DWG Importer for some hints.



Example Output

20
06
08
07
12
01
20
07
08
09
05
04
05
10
10
04
01
03
11
02

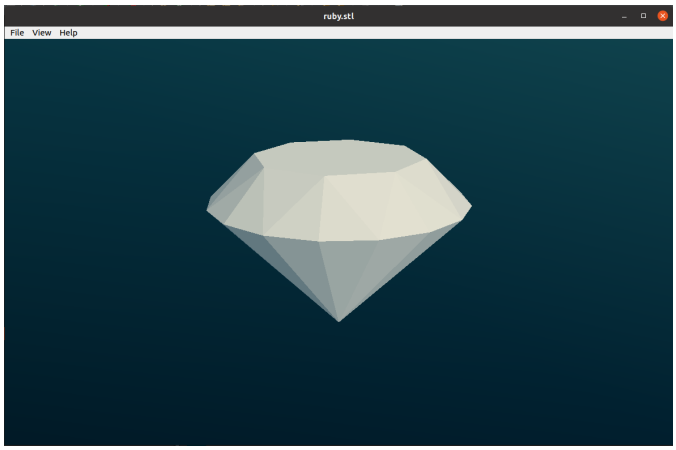
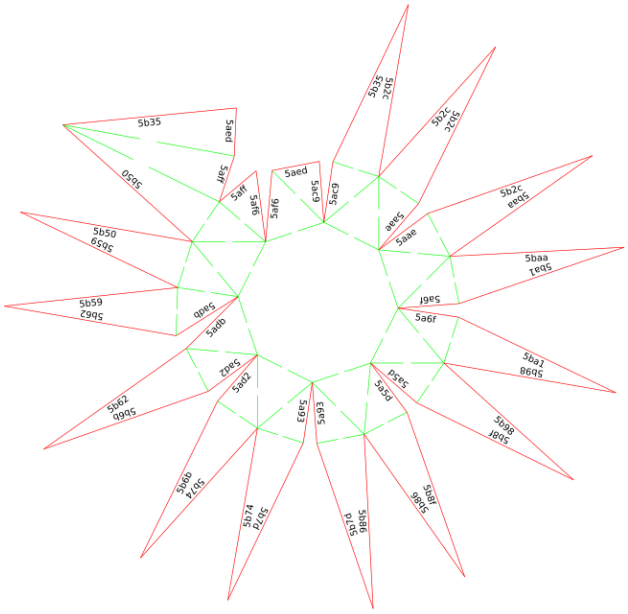
Papercraft Unfold

This tool converts a STL/OFF/PLY/OBJ into binary STL Format. The STL then gets unfolded (flattened) to make a papercraft model.

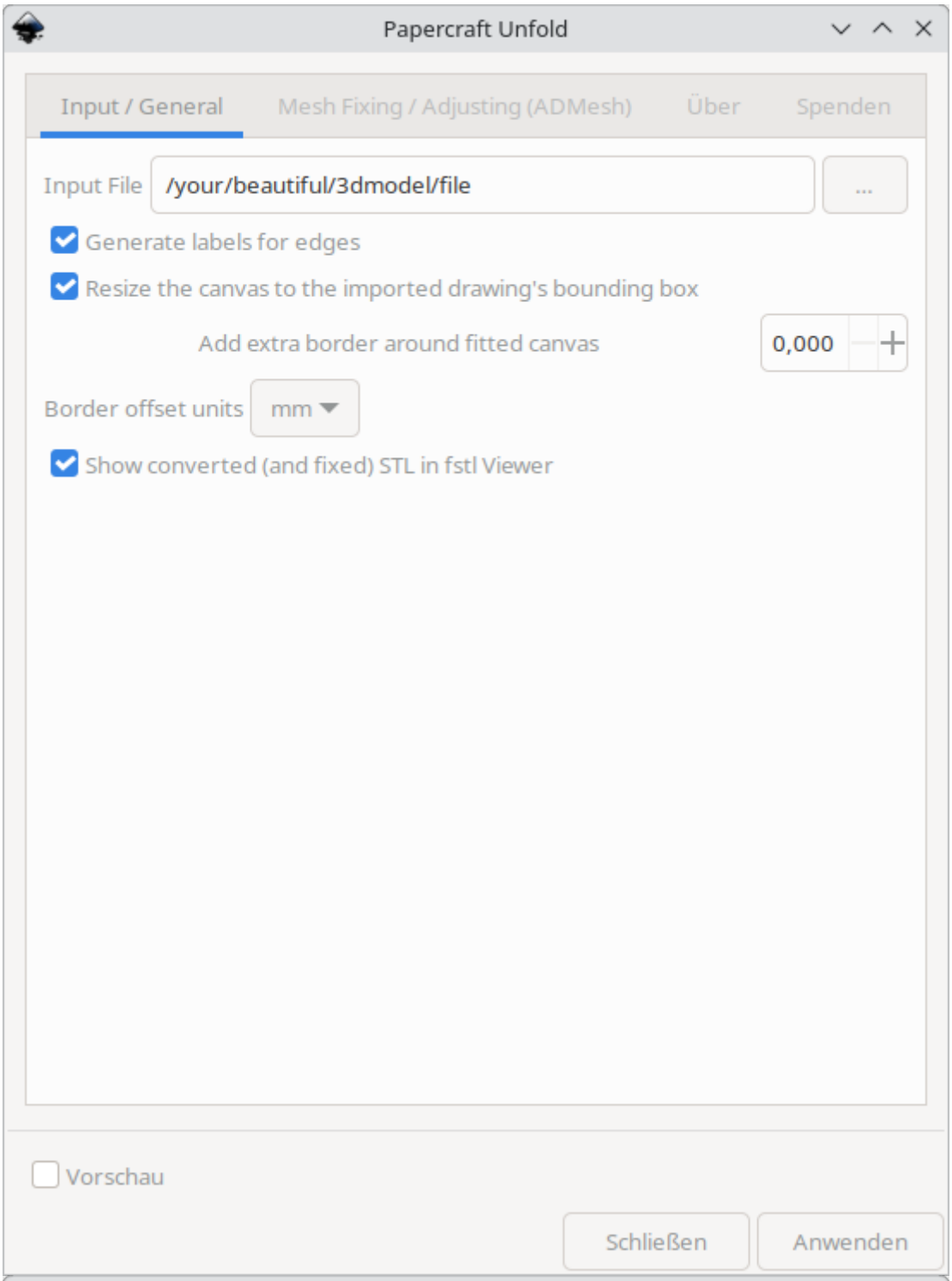
It utilizes https://github.com/osresearch/papercraft and

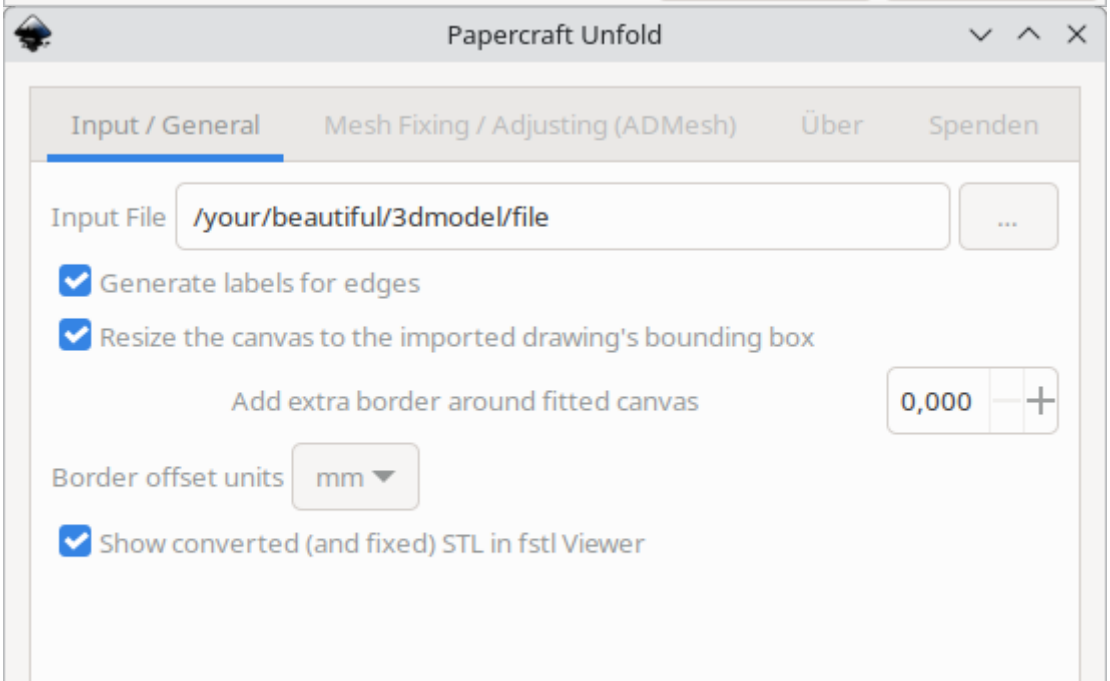
https://github.com/admesh/admesh

> Avoid importing STL files with a lot of surfaces. Larger files require intense computing power. It's better to use simplified low-poly models (with a decent amount of triangles). See Simplification and remeshing of STL parts

3D STL preview	Papercraft Unfold output
	

Usage


Papercraft Unfold
Input / General
Mesh Fixing / Adjusting (ADMesh)
Über
Spenden
Input File
/your/beautiful/3dmodel/file
...
Generate labels for edges
Resize the canvas to the imported drawing's bounding box
Add extra border around fitted canvas
0,000
Border offset units
mm
Show converted (and fixed) STL in fstl Viewer
Vorschau
Schließen
Anwenden


Papercraft Unfold
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Add extra border around fitted canvas
0,000
Border offset units
mm
Show converted (and fixed) STL in fstl Viewer

Manual steps

PaperCraft Unfold tool compilation on Windows (and Linux)

The folowing steps how to compile `unfold` binary which is used for the upper mentioned Inkscape plugin.

Start Cygwin (Windows) or use your regular bash shell (Linux)

On Linux we can easily compile using `gcc` and `make`. For Windows executable we can use cygwin with installed `gcc` and `make` libraries.

Compile

```
cd /c/
git clone https://github.com/osresearch/papercraft
cd papercraft
make
cp C:\Babun\.babun\cygwin\bin /c/papercraft/
explorer .
```

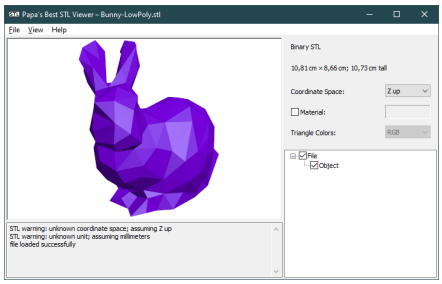
> Papercraft Unfold supports option to generate labels for edges. We can make separate compilations to have both variants. (variable: `static int draw_labels = 0;`)

Start cmd shell

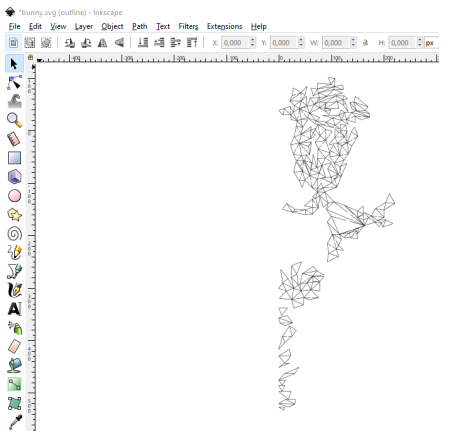
```
cd C:\papercraft
unfold < Bunny-LowPoly.stl > bunny.svg
#or explicitely with extension .exe
unfold.exe < Bunny-LowPoly.stl > bunny.svg
```

Check output and compare with input

Bunny-LowPoly.stl	**unfold < Bunny-LowPoly.stl > bunny.svg**	**bunny.svg**




```
header: 'Bunny-LowPoly.stl'
num: 292
Starting at poly 64
group 1: 246 triangles
group 2: 28 triangles
group 3: 2 triangles
group 4: 6 triangles
group 5: 2 triangles
group 6: 2 triangles
group 7: 2 triangles
group 8: 1 triangles
group 9: 1 triangles
group 10: 1 triangles
group 11: 1 triangles
```



Paperfold

About

Paperfold is another flattener for triangle mesh files, heavily based on https://github.com/felixfeliz/paperfoldmodels by Felix Scholz aka felixfeliz.

Possible input files are STL, Wavefront OBJ, PLY and OFF. (possible import file types with OpenMesh in principle: https://www.graphics.rwth-aachen.de/media/openmesh_static/Documentations/OpenMesh-8.0-Documentation/a04096.html)

Prepare to install openmesh

To run this extension you need to install OpenMesh bindings with python pip. When installing Paperfold by installing MighyScape, this will already be done for you on Linux systems. Else:

Ubuntu

```
sudo apt install cmake
sudo apt install g++
sudo apt install python3-dev
pip3 install openmesh
```

Fedora

```
sudo dnf install cmake
sudo dnf install g++
sudo dnf install python3-devel
pip3 install cmake
pip3 install pybind11
pip3 install openmesh
```

Windows

1. Windows **requires** CMake executable (but version 3, not 4!)

2. Install MS Visual Studio Community Edition → If you receive an error like "NMake Makefiles does not support platform specification, but platform x64 was specified." In case the instalation fails you can also try to install precompiled Windows binaries from https://gitlab.vci.rwth-aachen.de:9000/OpenMesh/OpenMesh
3. Install openmesh bindings

```
pip3 install openmesh
```

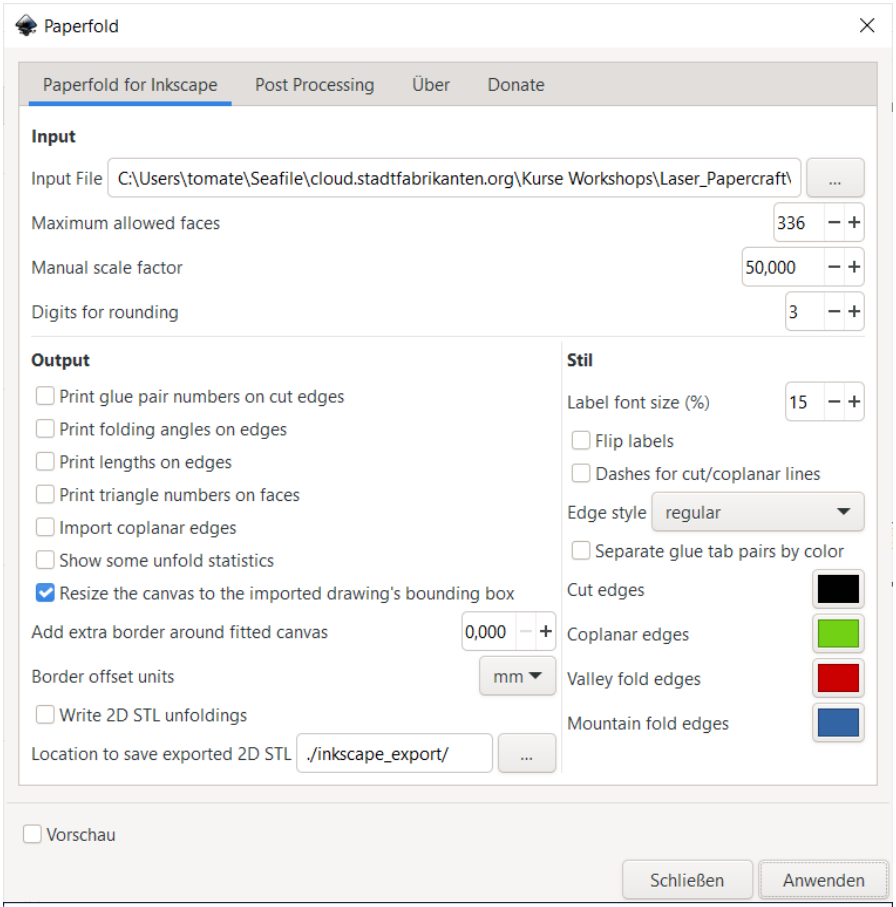
How it works

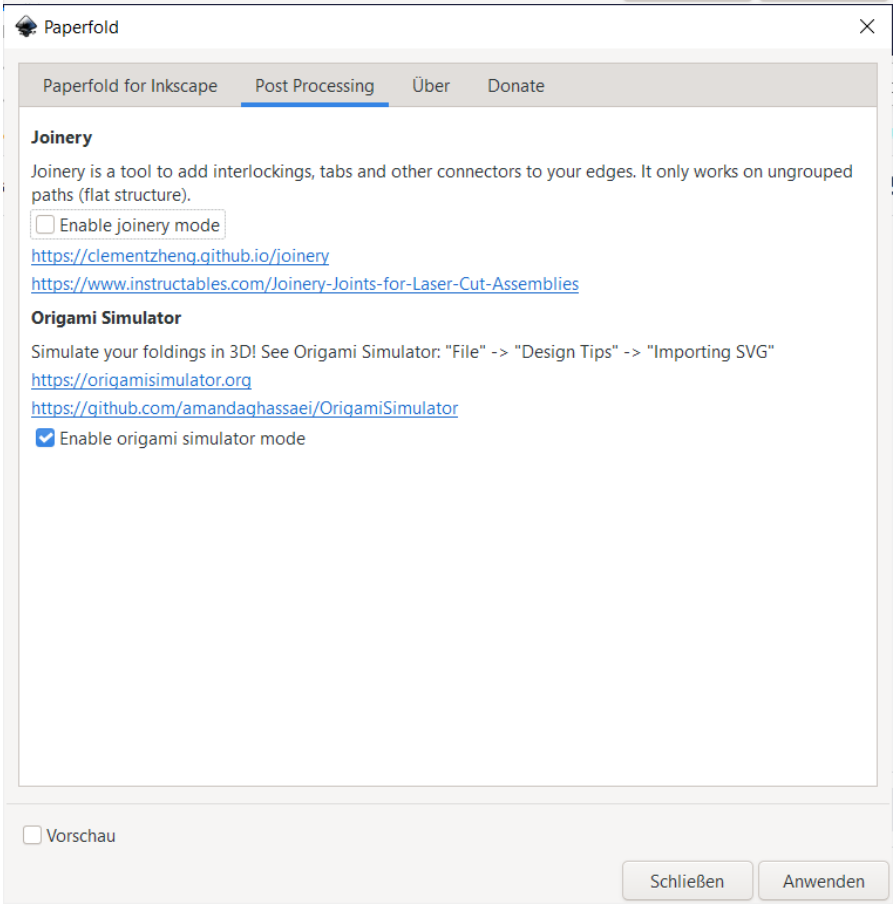
The algorithm of paperfoldmodels consists of three steps:

1. Find a minimum spanning tree of the dual graph of the mesh.
2. Unfold the dual graph.
3. Remove self-intersections by adding additional cuts along edges.

Reference: The code is mostly based on the algorithm presented in a by Straub and Prautzsch (https://geom.ivd.kit.edu/downloads/proj-paper-models_cut_out_sheets.pdf).

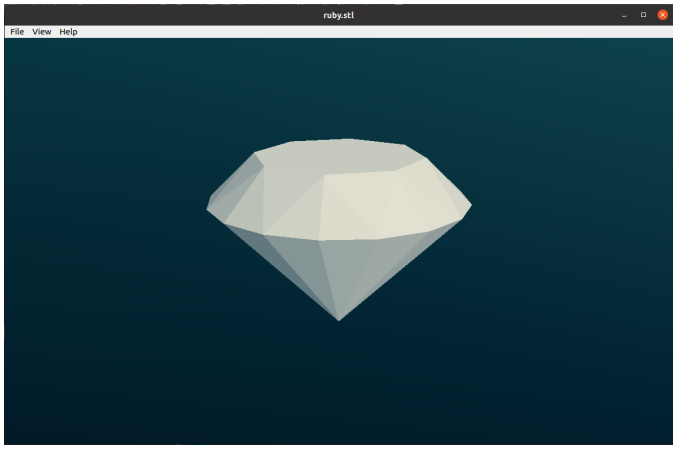
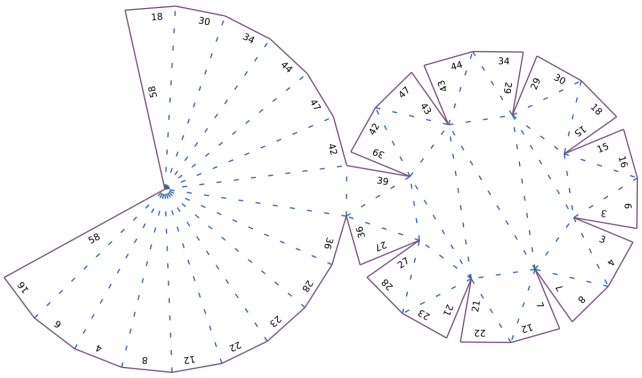
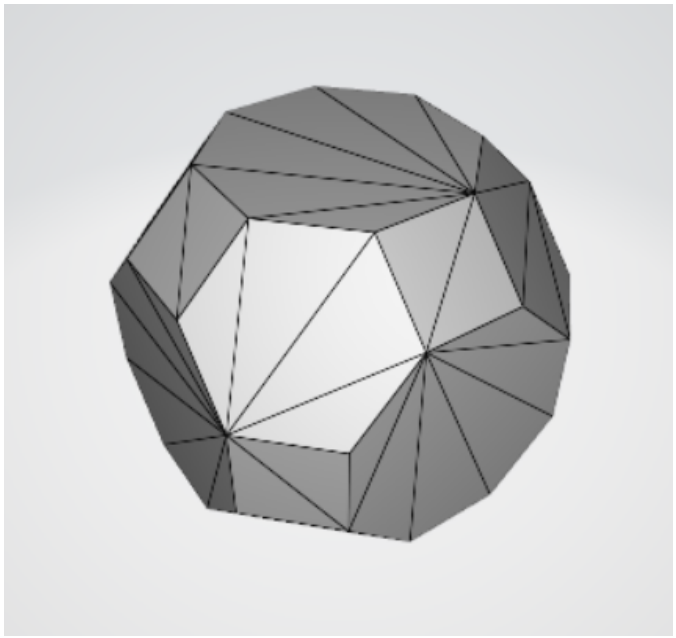
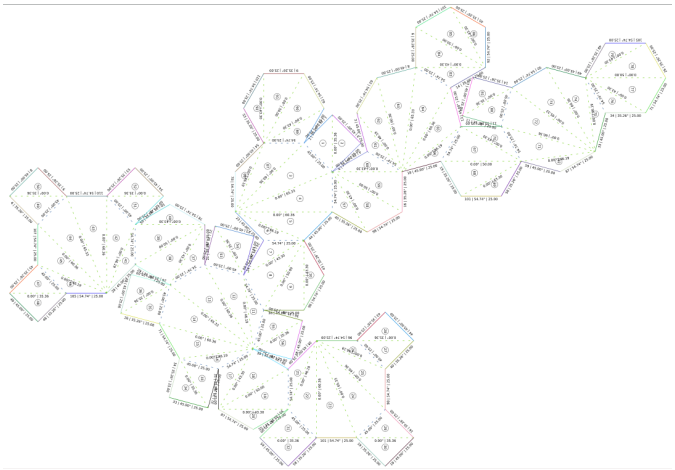
> Please also have a look at DXF 2 Papercraft and Papercraft Unfold.





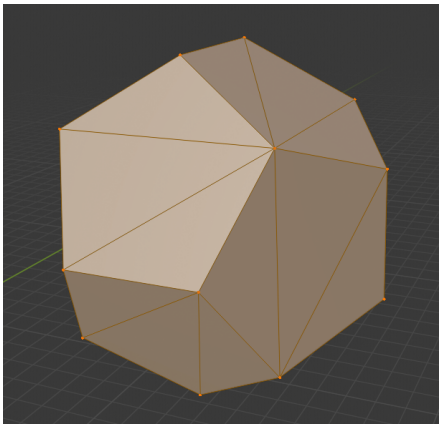
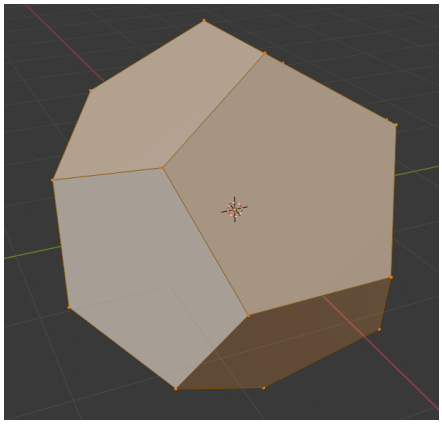
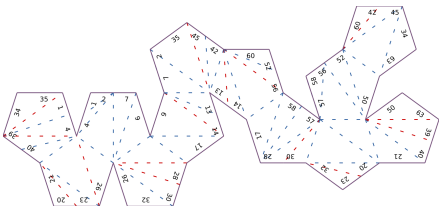
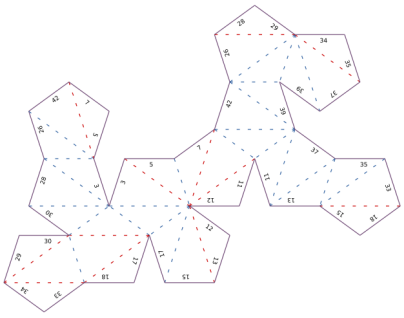
Example with a Ruby model file

https://www.thingiverse.com/thing:1315127/files

STL preview	Unwrapped by Paperfold
	
	

Differences between poly facets and triangles

There is a great difference which comes fromt the input file. If you use polygonal input file, the unfolded mesh looks better because it has less useless folds and glue tab numbers. There is no algorithm to remove fold lines for coplanar adjacent triangles which form a polygon facet.

	Triangle mesh file (model saved stl)	**Polygonal facets (model saved as .obj)**
3D mesh preview (Blender)		
Unfolding		

Hot tips

- Add some joints to your paperfold using Joinery
  - https://clementzheng.github.io/joinery
  - https://www.instructables.com/Joinery-Joints-for-Laser-Cut-Assemblies
- ...or add tabs using Tab Generator
- Simulate using Origami Simulator
  - https://origamisimulator.org
  - https://github.com/amandaghassaei/OrigamiSimulator
- generate cool model files from more complex 3d models using a vertice reducing tool: