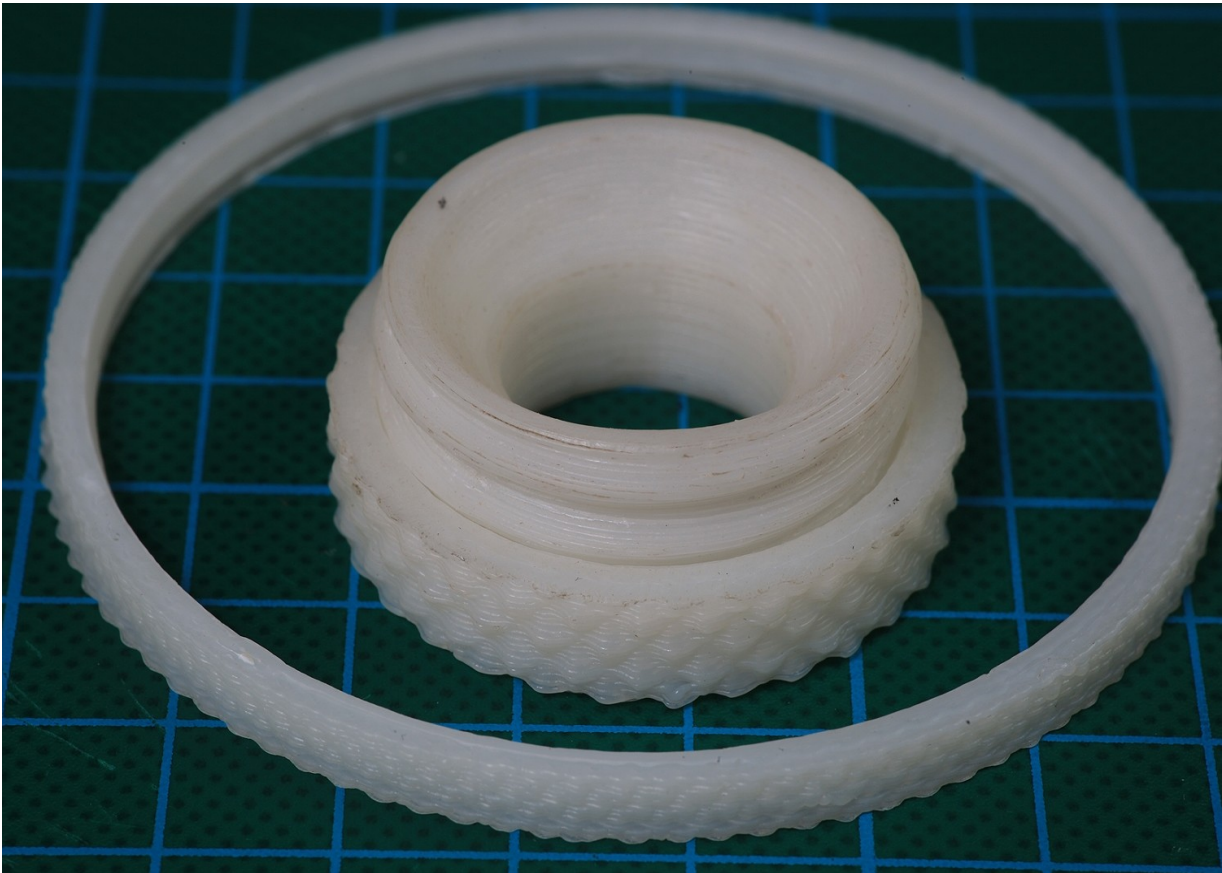# Knurled Surface Finishing Library

by aubenc @ Thingiverse

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Introduction

'knurledFinishLib.scad' is an OpenSCAD script to create Knurled surface finished cylinders like, for example, the one in the image next to this text.

WARNING:
Please take in account that when talking about the *top* and the *bottom* of the knurl what I mean is:

Top: The points of the knurl's polyhedron that are farther from the cylinder axis (Z)

Bottom: The ones that are closer to the cylinder axis
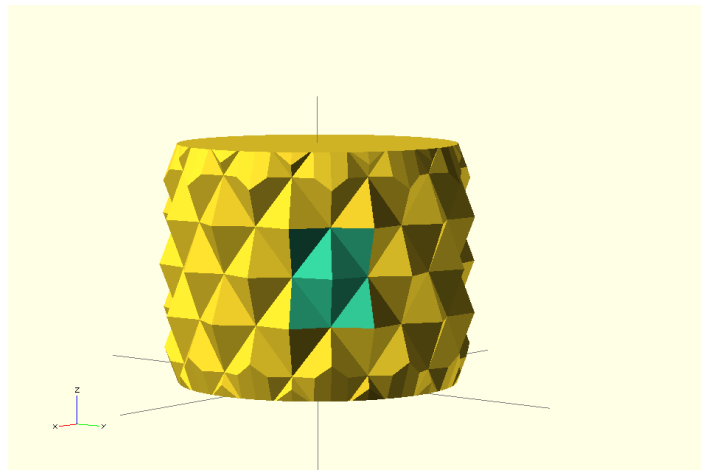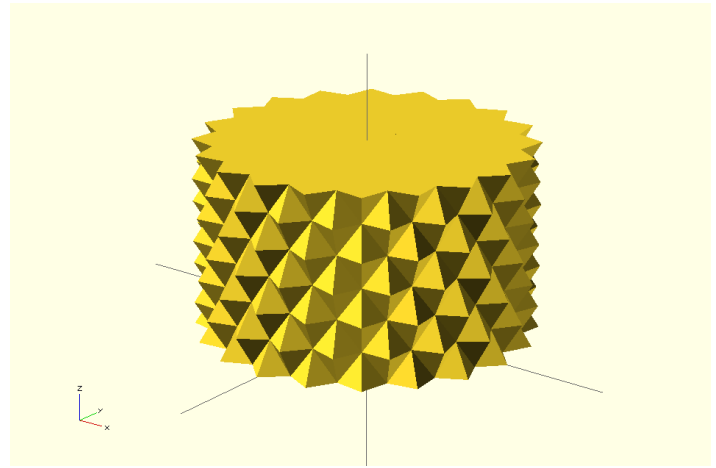
This is done by creating a bunch of knurl shaped polyhedrons, thus... yes, OpenSCAD may (will) find soon some problems to render and it may also take some time to compile.

In blue, you can see the external face of the polyhedron.

Because this is made without much (any) science, you'll not be allowed to define fancy things like spiral angles an such.

The parameters that this library requires can be classified in three groups:

1. Parameters for the cylinder: Height and Outer diameter.
2. Parameters for the knurl: Width, Height and Depth.
3. Smoothing parameters: One for the cylinder's ends (bottom and top) and another for the surface.

'knurledFinishLib.scad' has 3 modules.

1. knurled_cyl(...) Is the one to be called by your OpenSCAD script. It receives your desired parameters, uses them to compute few more ones and makes a boolean intersection between the other two modules.

2. shape(...) It's a union of three cylinders, a conical cylinder for the bottom, a straight one for the middle section and another conical for the top.

3. knurled_finish(...) Is the heart of this library. In this module is where the polyhedron replicates itself as many times as required to envelop all the surface of the cylinder.

Yep! The name of the modules is quite horrible but this is nothing compared with the names of the constants (call it variables If you like) used by the library.

Deep into the Parameters...

Basically, this is how this library will be used:

        knurled_cyl(
                        Cylinder Height,
                        Cylinder Outer Diameter,
                        Knurl Width,
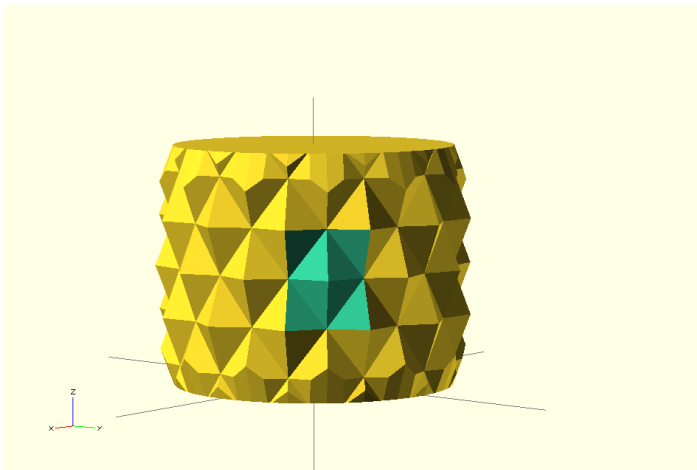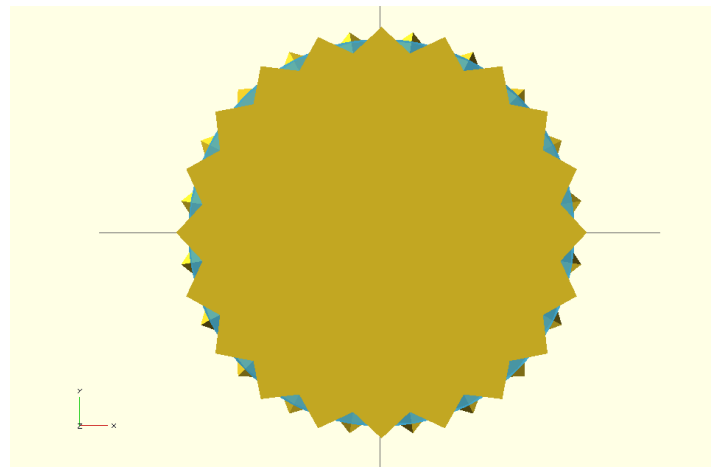   Knurl Height,
                        Knurl Depth,
                        Top and Bottom ends Smoothing,
                        Surface Smoothing);

All the parameters are in absolute values (e.g. millimeters) but the last one which is a percentage.

Cylinder Parameters

Cylinder Height is exactly what it says it is, the height of the cylinder in mm.

Cylinder Outer Diameter. This one may be a little confusing. It is not the diameter at the highest point of the knurl, not neither the diameter at the lowest part of it BUT the diameter at half the depth of the knurl.

Hopefully the side image can give you an idea. In this image you can see a blue cylinder which diameter matches the Outer Diameter parameter

Knurl Parameters

Knurl Width in short: Is the size of the polyhedron in the XY plane at... *some point* of the knurl's depth.

Knurl Height is the Z size of the polyhedron.

Knurl Depth... How to explain in a easy way if you really need me to explain this?

In the figure at the left, you can see a polyhedron generated with 6mm for the width, 8mm for the height and 2mm for the depth.

Top and Bottom ends Smoothing Parameter

If you where reading at the beginning when we where talking about the shape() module, there where three cylinders involved.

What the library does to smooth the ends is make those ends have the shape of a conical cylinder where the bottom (for the bottom end) or the top (for the top end) have a radius equal to the radius of the lowest point of the knurl.

The radius for other end of this conical cylinder has the same value than the radius for the top of the knurl.

Finally, the height of this conical cylinder equals the value that has been entered as *Top and Bottom ends Smoothing Parameter*

(Yes it's true, top and bottom use only one parameter so you cannot set a different smoothing for each of them. Just a matter of keep it as simple as possible, sorry).

The figures used to show how this parameter works are using an 'easy' knurled finished cylinder where the height of the cylinder it's a multiple of the height of the knurl.
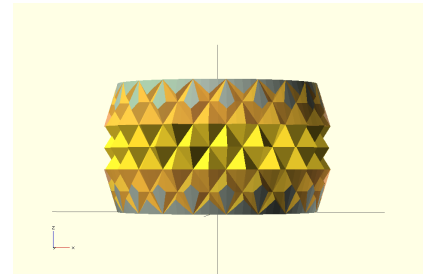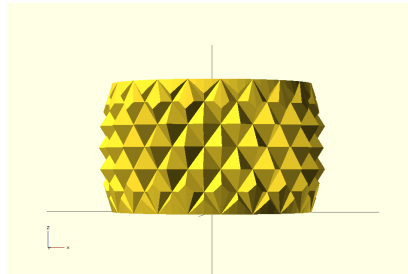
In the case that the height of the cylinder is not an integer number of times the height of the knurl, the knurled surface is centered into the height of the cylinder.
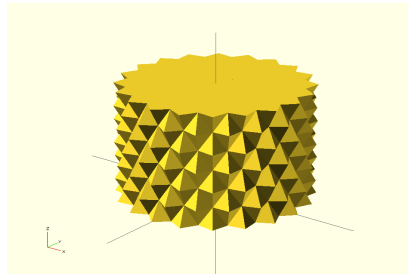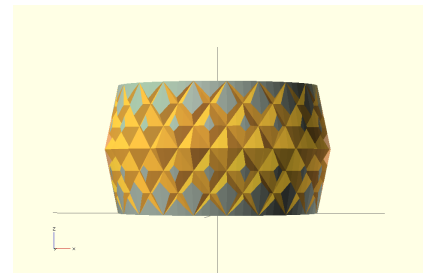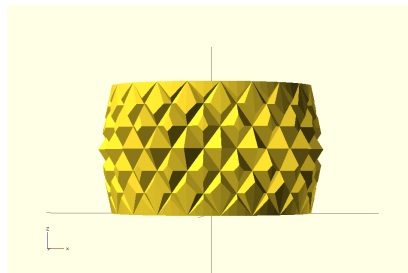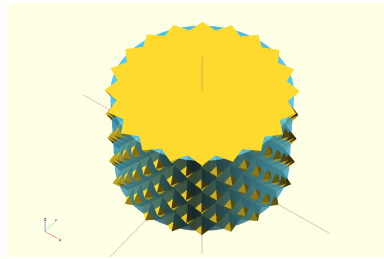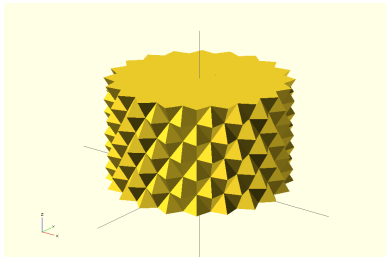
No smoothing at all
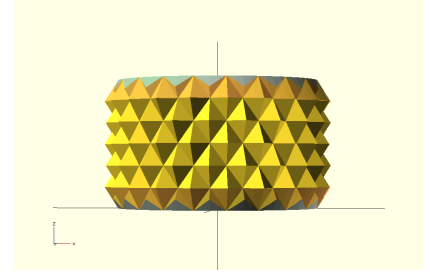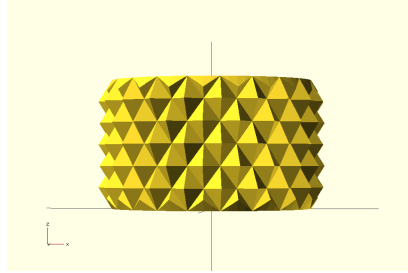
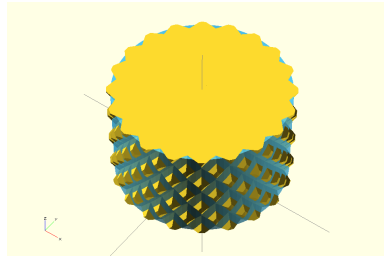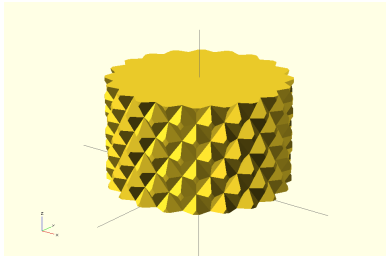Ends Smoothing value equal to half the knurl's height

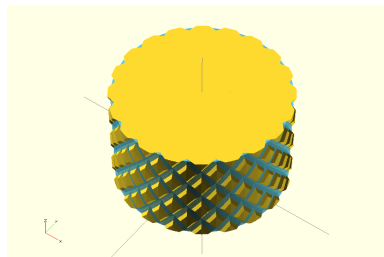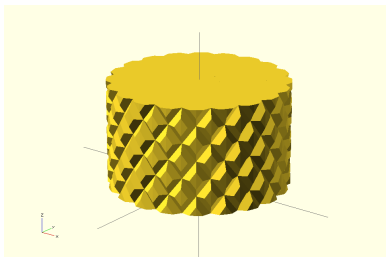Ends Smoothing value equal to the knurl's height

Ends Smoothing value equal to half of the cylinder's height, in this 'easy' case this is also the same value than one and a half times the knurl's height.
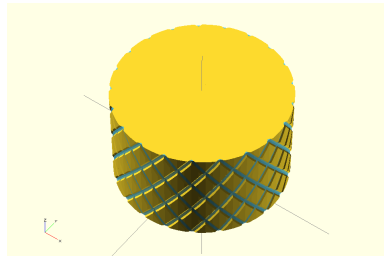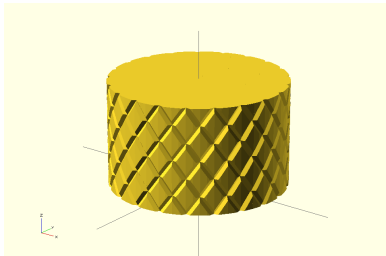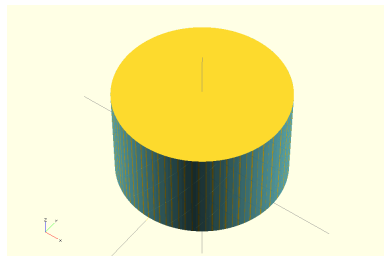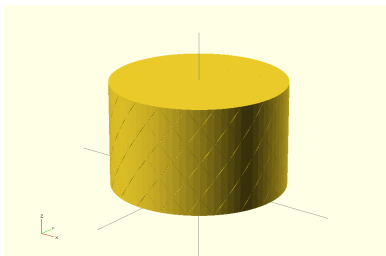
0% Smoothed

25% Smoothed

50% Smoothed

75% Smoothed

100% Smoothed

Surface Smoothing

This parameter differs from the others in the units that are used.

Here, instead of millimeters the library uses a percentage. The range is thus between 0% and 100%.

(Nothing in the code prevents the use of other values - negative ones or bigger than 100).

This parameter changes two aspects of the knurled cylinder.

First: It moves the bottom of the knurl farther from the center of the cylinder and, second; it flattens the knurled surface, the top of the knurl.

The figures show a 0%-100% range with 25% increments.