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# Extrude SVG files

## Overview

This tutorial describes the process of extruding SVG files, which are 2D images, to create 3D meshes for your models in Gazebo. It is sometimes easier to design part of a model in a program like Inkscape (https://inkscape.org/) or Illustrator (www.adobe.com/Illustrator).

Before starting, make sure you're familiar with the Model Editor (http://gazebosim.org /tutorials?tut=model_editor).

This tutorial will show you how to make a custom wheel as an .svg in Inkscape, and import it into Gazebo so that it can be attached to a robot.

### Using the Inkscape SVG editor



There are many SVG editors. For this tutorial, we will use the open source Inkscape program (see installation instructions (https://inkscape.org/en/download) ).

This is the wheel SVG file (https://github.com/osrf/gazebo_tutorials/raw/master/extrude_svg /files/wheel.svg) used in this tutorial.
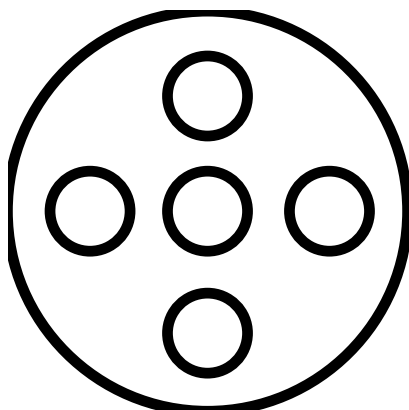


### Document preparation

Start Inkscape. This will create a blank document. First, lets change the document size to better accommodate our wheel: under the `File`->`Document` properties menu , select the `Page` tab and change the document size to a custom size of 100.0 x 100.0 mm.
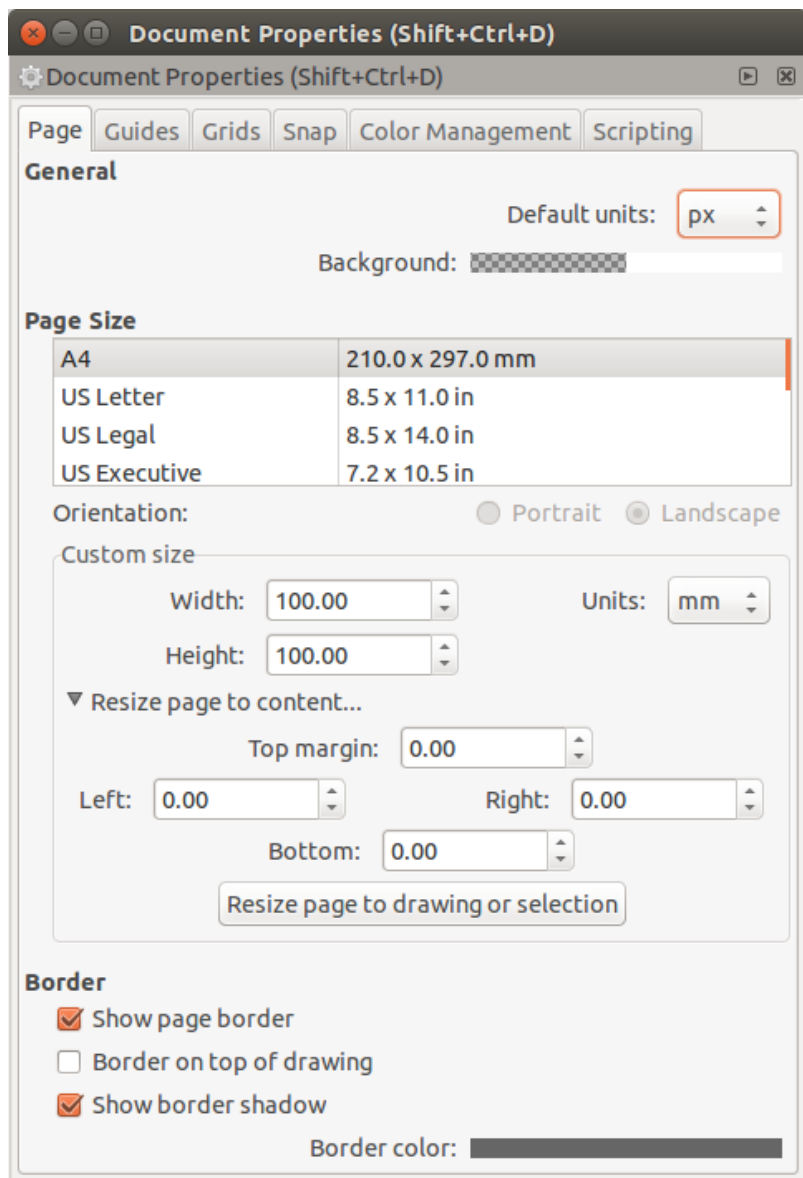
Then, in the same dialog, select the **Grids** tab, press the **New** button to create a custom grid. Then, check the **Enabled** , **Visible** , and **Snap** to visible grid lines only options. Change **Spacing** X and **Spacing** Y to be 10.
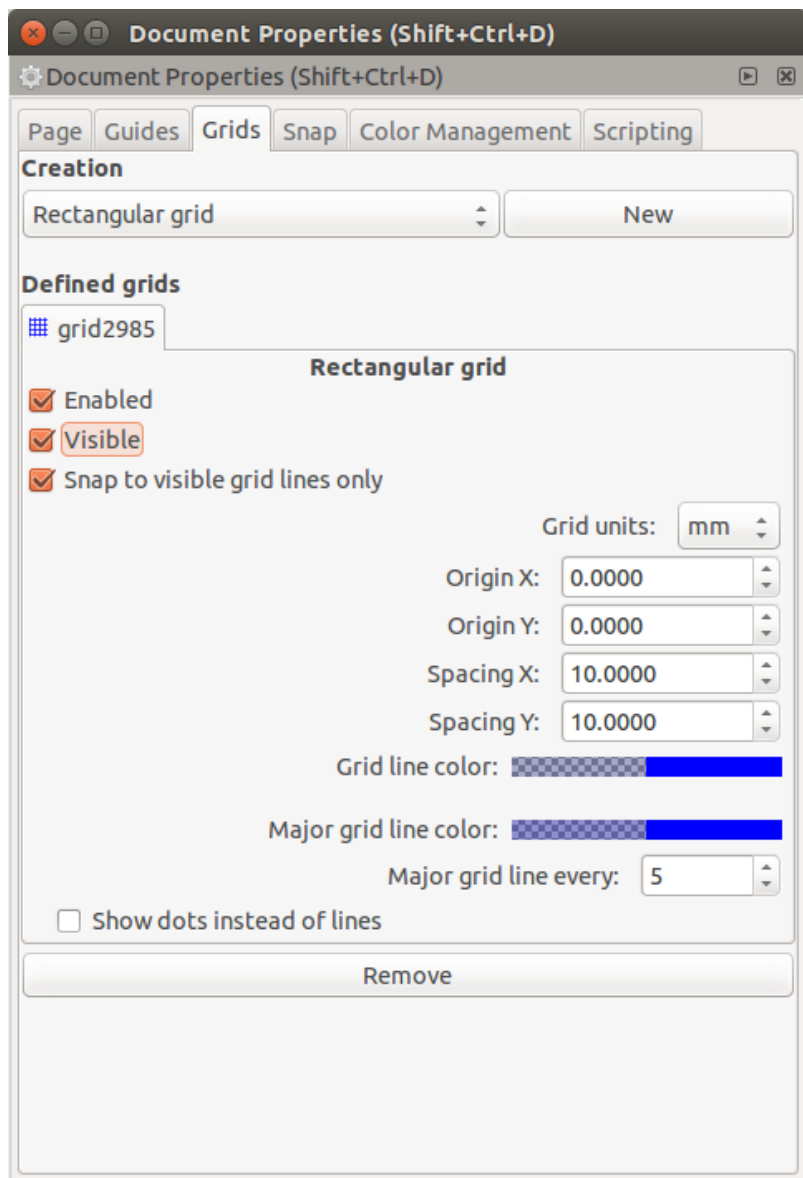
You should end up with a document looking like this:
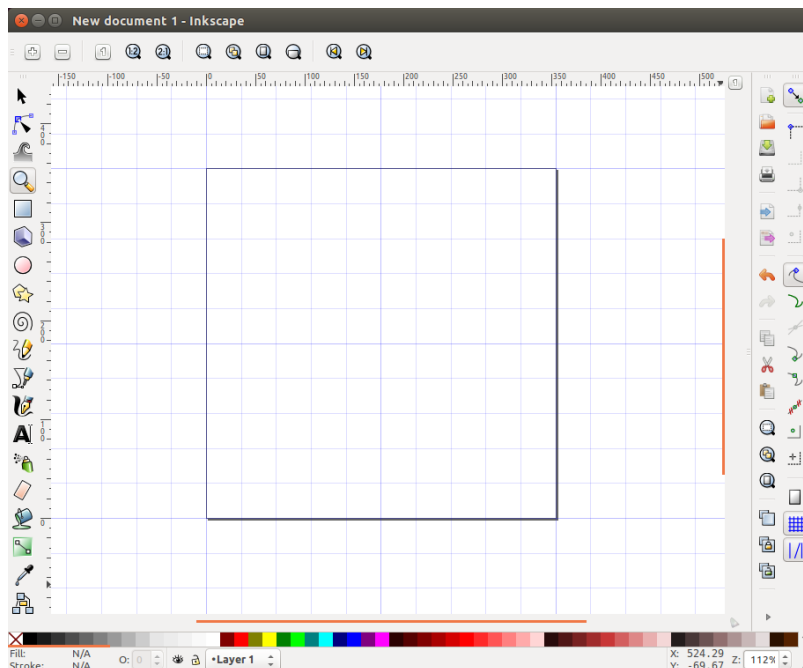


# Draw

You can use the different tools (pen, text, stars and shapes, etc.) to create your geometry. In this example, the wheel is made from circles (pressing the Shift Key you can start your circle from the center, and using the CTRL key allows you to keep the roundness of the shape). It is possible to combine shapes together, making sure that paths are closed and that the part has a proper thickness.

**Note**: a stick figure or two circles that touch each other would not result in valid Gazebo models. The SVG paths must create an closed contour with holes, where the holes cannot touch the contour or other holes. Holes inside holes are treated as solid parts (and they can have holes, too).
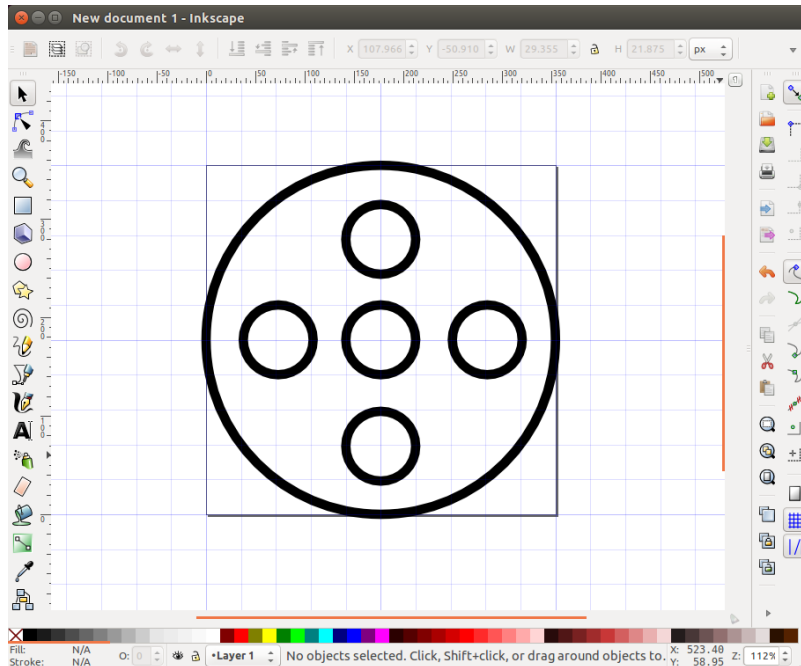


Gazebo only imports `paths`, but it's easy with Inkscape to transform any shape to a path. Select `Select All` from the `Edit` menu. Then select the `Path` -> `Object to Path` menu item. This will transform every object into separate paths and sub paths. This transformation is irreversible, so if you transform text into paths, you will not be able to alter the text.
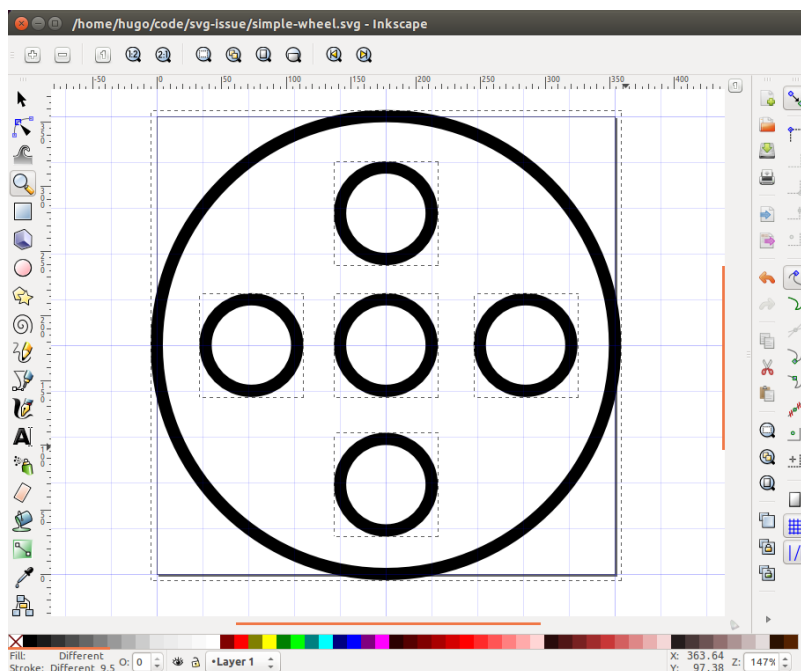


Gazebo does not support grouping. Use the `Ungroup` from the `Object` menu to separate groups of paths.

## Save your drawing

Save your drawing to an SVG file you can use later in Gazebo. Use the `Save` option from the `File` menu.

## Create a Gazebo Model

SDFormat (http://sdformat.org) does not support SVG directly; it supports 2D poly lines. The Gazebo Model Editor has an import mechanism that extracts the poly lines from SVG files, and saves them as an SDF model file.

Launch Gazebo and Select `Model Editor` from the `Edit` menu to enter the Gazebo Model Editor mode (as opposed to the simulation mode).
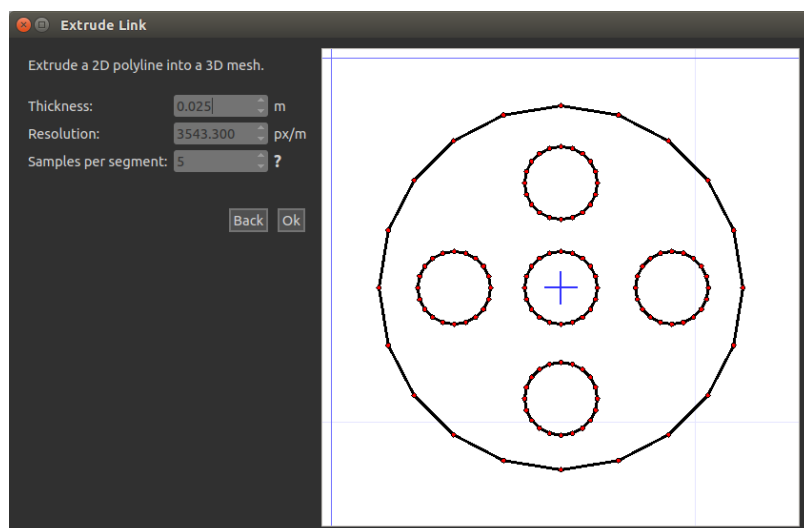
Then press the `Add` button in the `Custom Shapes` section of the `Insert` tab.
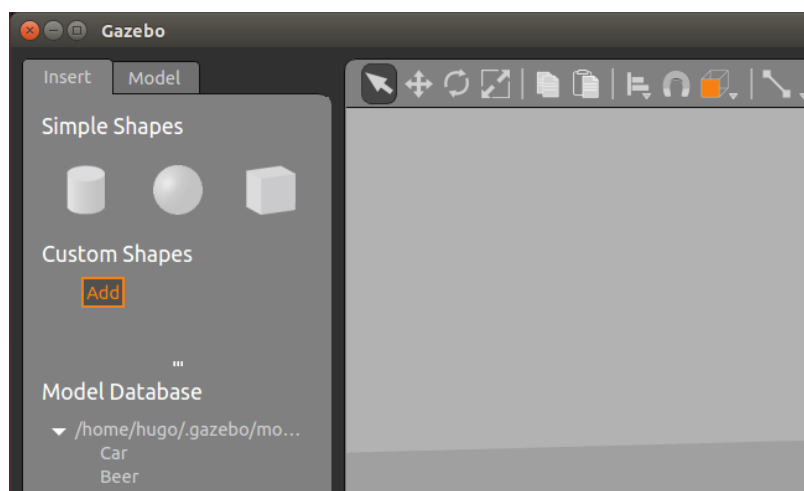


This will open the `Import Link` dialog from where you can select the SVG file by pressing the `Browse` button.
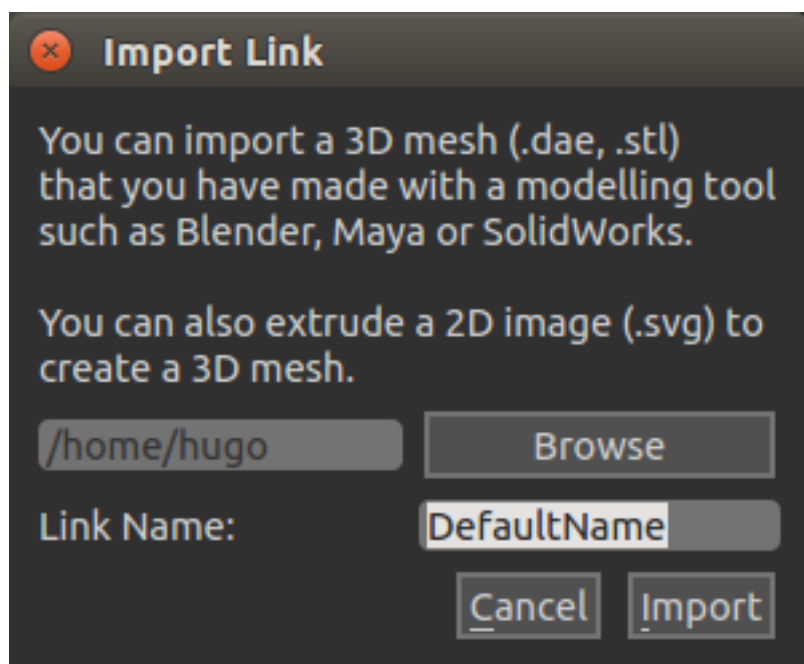


Once the file has been selected, press the `Import` button to open the `Extrude Link` dialog.

The dialog allows you to set parameters of the extrusions:

- **Thickness**: How thick the link will be. This corresponds to the extrusion height in the $z$ axis. For the SVG path shown on the right, the axis of extrusion is outwards from the screen.

- **Resolution**: How many pixels in your SVG correspond to a meter. The default value (3543.3 px/m) corresponds to 90 dpi (dots per inch), which is the default resolution for several editors, including Inkscape. If your model shows up the size you'd like in Inkscape when you display the units as meters, you shouldn't change the resolution value.

- **Samples per segment**: This indicates into how many segments to divide each of the curved paths in the SVG. The more segments, the more complex your link will be. It doesn't change anything for straight paths.
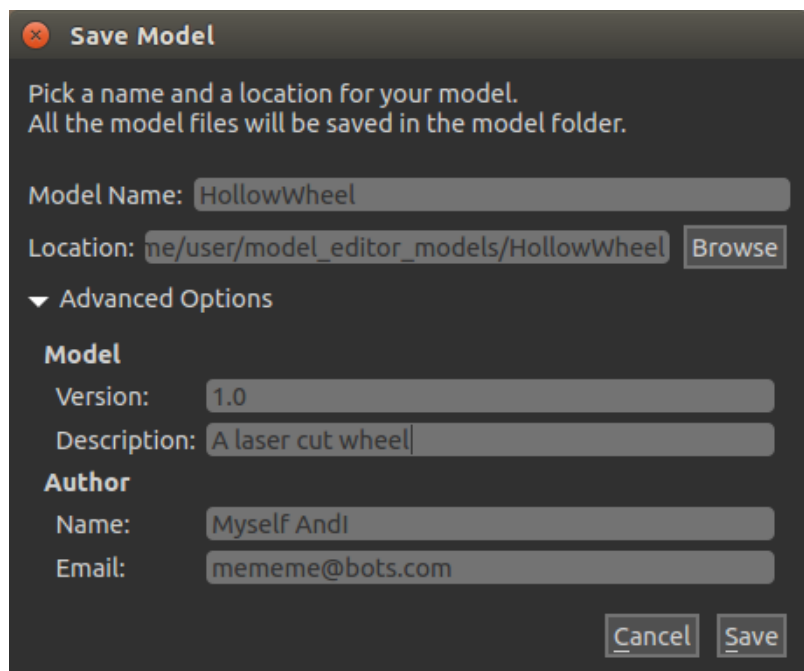
On the right, you can see the path extracted from your SVG. The red points are the summit of the triangulation of the extruded 3D model.

Set the thickness of the wheel to 0.025 m, and press OK . Your new link should appear in the 3D view.

A new link is created, and it comes with a default collision shape that is a copy of the generated 3D mesh.
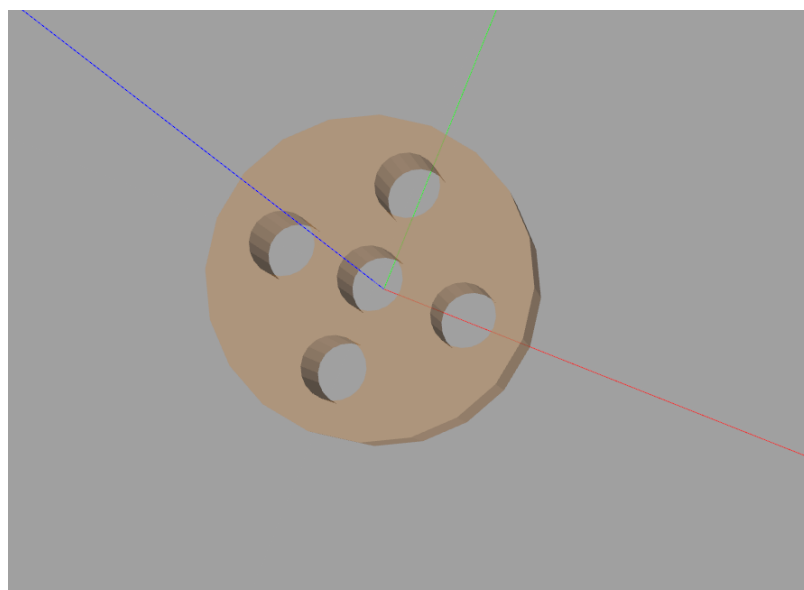
Next, select **Exit Model Editor** from the **File** menu. Gazebo will prompt you to save the new model to disk. Press the **Save and Exit** button on the Exit dialog, and the **Save Model** dialog will appear.



Set the name of the new model to "HollowWheel", and fill in the information under the **Advanced Options** section. Press the **Save** button.

> Your new Gazebo model is now ready to roll ;-)

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