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## Stiff brim

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**Title: Stiff Brim**

Authors: Tom Heijmans, Arjen Dirks, Ultimaker B.V. Geldermalsen, The Netherlands.

Abstract: This publication relates to the field of additive manufacturing. It more specifically relates to a method of printing a stiff brim on a flexible build plate without influencing the quality of the 3D printed part.

Often, in order to make a 3D print adhere more reliably to a build surface, a brim is printed around the 3D printed object. Normally, the brim is only one layer high. Using a brim improves the adhesion of the part during the print.

However, when using a flexible build plate, it is difficult to take a 1-layer brim off of the build plate. This is especially hard in cases where the part is removed from the flexible build plate and separated from the brim. Skirts face the same issue, they are very hard to remove from flexible build plates.

A user could add multiple layers to the brim to make it stiffer, and therefore easier to remove from a flexible build plate. This option however affects the print quality of the first layers due to the travel moves from part to the brim.

We now suggest to make a brim with multiple layers, but only at outer parts of the brim. The inner part of the brim is created using only one single layer, but multiple brim layers are printed to make the brim stiffer at its circumference. This way of printing a brim has two advantages. First, the brim will come off of the flexible build plate more easily when the build plate is flexed. Secondly, the brim will deform less when a print is warping, increasing the adhesion power to the build plate.

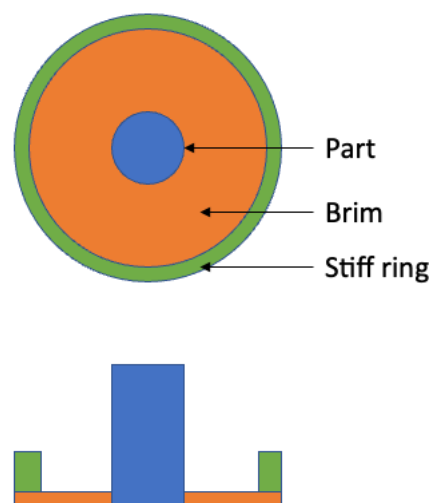


Fig. 1

Figure 1 schematically shows a top view and a side view of a very simple 3D print (blue) with a circular shaped brim (orange) having a circular shaped ring (green) at its circumference. By adding

multiple layers to the outer ring of the brim we achieve a stiffer outside of the brim which makes removing it from the flexible build plate easier.

The ring of the brim can be printed along with the first layers of the 3D printed part. However, it is preferred to print the brim first before printing the 3D part starts. In this way, the extra travel moves between the printed part and the ring avoided, creating a more continuous printing process and thereby increasing the print quality.

It is noted that the brim layers can be printed in one go, up to the height at which the printhead can still safely travel over the brim in order to print the 3D printed object. Furthermore, we should design a minimal distance between the printed part and the ring to ensure a certain distance from the 3D part to make sure that the nozzle does not collide with the printed part.

In the printing strategy wherein first the brim is printed, then the stiff outer ring and afterwards the 3D part, it is ensured that the number of travel moves is minimized. In order to set this up correctly, the height difference between the nozzle tip and the printhead bottom surface must be known by the slicing software.

Finally it is noted that, when there are multiple prints with separate brims, z-hops must be used to travel from part to part after the multiple brim layers have been printed.

It is clear to the reader that this solution will apply to many different shapes of brims, and that the idea is not limited to circular shaped brims. It is also possible to create the stiffer parts of the brim only on certain parts of the circumference of the brim. Also it is conceivable to vary the height of the ring, so that for example at one location, the ring forms a handle for a user in order to remove the brim by pulling at the handle.