Individual Assignment 2

MECHENG 4B03

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Achieving Goals

The first prototype chalk roller I think was inadequate in achieving the goals I set out. The tolerancing was off, making it difficult to roll and contain the chalk properly. It was large and clunky, and a bother to climb with. The print time was also extremely long, at almost 12 hours.

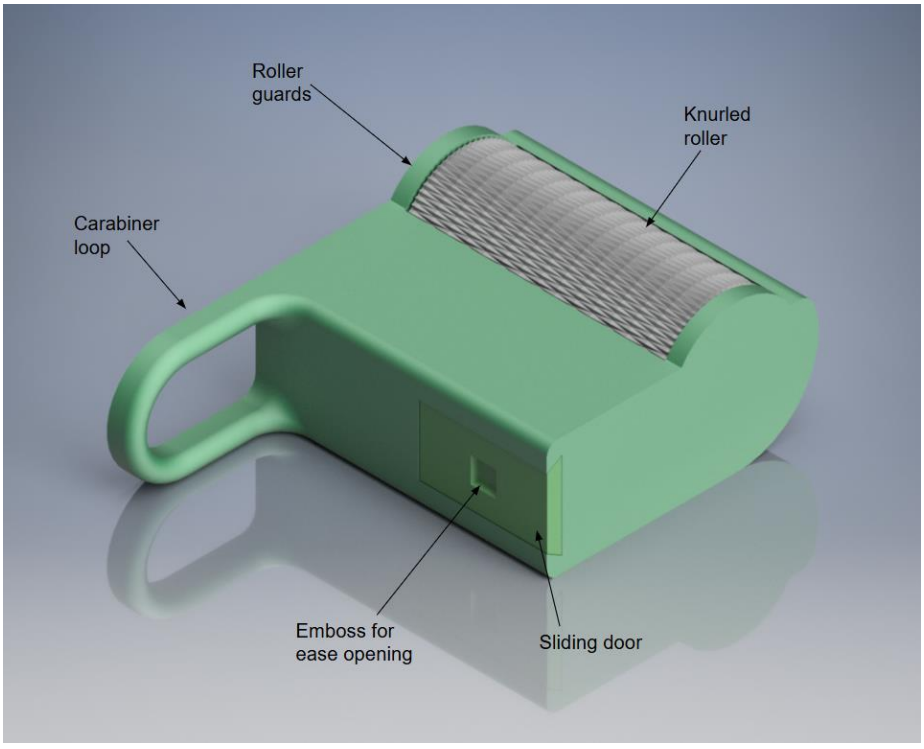
The second prototype was a significant improvement. The footprint of the device was greatly reduced: about ½ the size of the previous prototype. The tolerancing was improved for a tighter fit between the door and the shell, as well as smaller gaps between the roller surface and the opening in the shell. The device was designed to be print-in-place, greatly reducing print time and eliminating the need for assembly, glue, etc. Finally, a loop for a carabiner was added for easy attachment to a harness, ditching the leg-strap idea of fastening to the user.

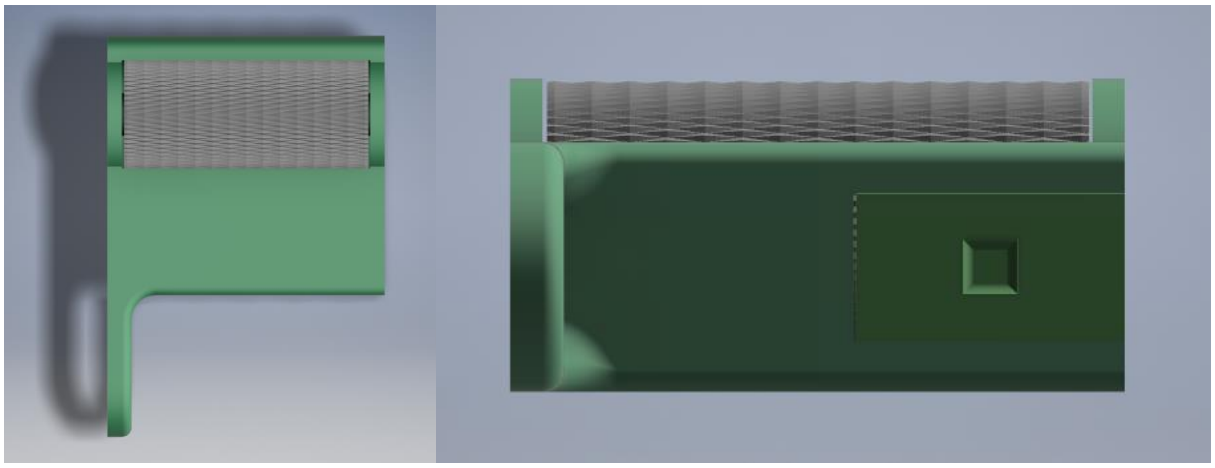
I think the second prototype achieved the goals I set out very well. I found it extremely easy to use; it was just the right size for my hand, the chalk gets caught in the knurling of the roller as planned and applies a thin, even coat to the surface of the user's hand. It also provides quick application in a pinch: it does not require 2 hands to operate, as pressing it against the leg when rolling applies more than enough leverage to keep the device still. Two quick rolls are enough to apply ample chalk and continue with the climb. As the footprint of the device is greatly reduced, it provides no obstacle or annoyance to the user. It still swings around because it is fastened by a carabiner, but it is so small that it's barely noticeable. The dovetail features on the small door allow for a secure fit, minimizing chalk spillage when the door is closed. Additionally, the dimple ensures the door is locked in place, such that the door never opens unless the user intentionally applies force to it. Initially the dimple was too large, so it was sanded down until the force required to open the door was sufficiently low. There's also an emboss on the outside of the door to grant the user additional leverage when opening/closing it.

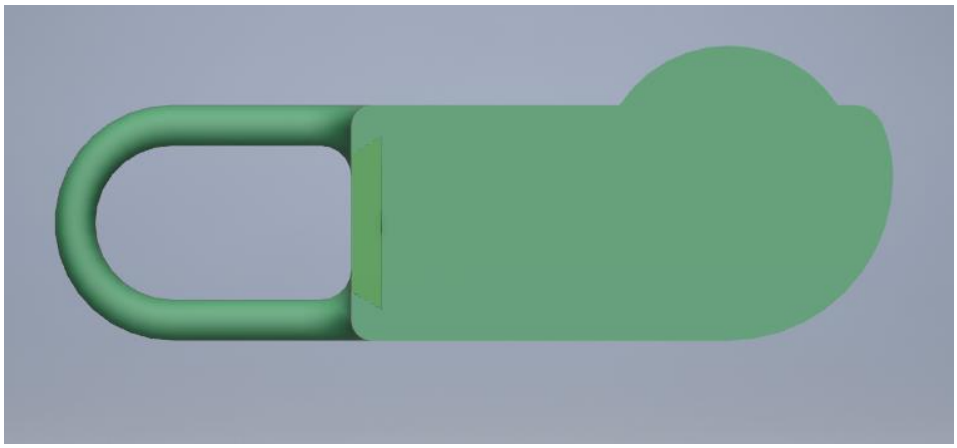
Design Changes

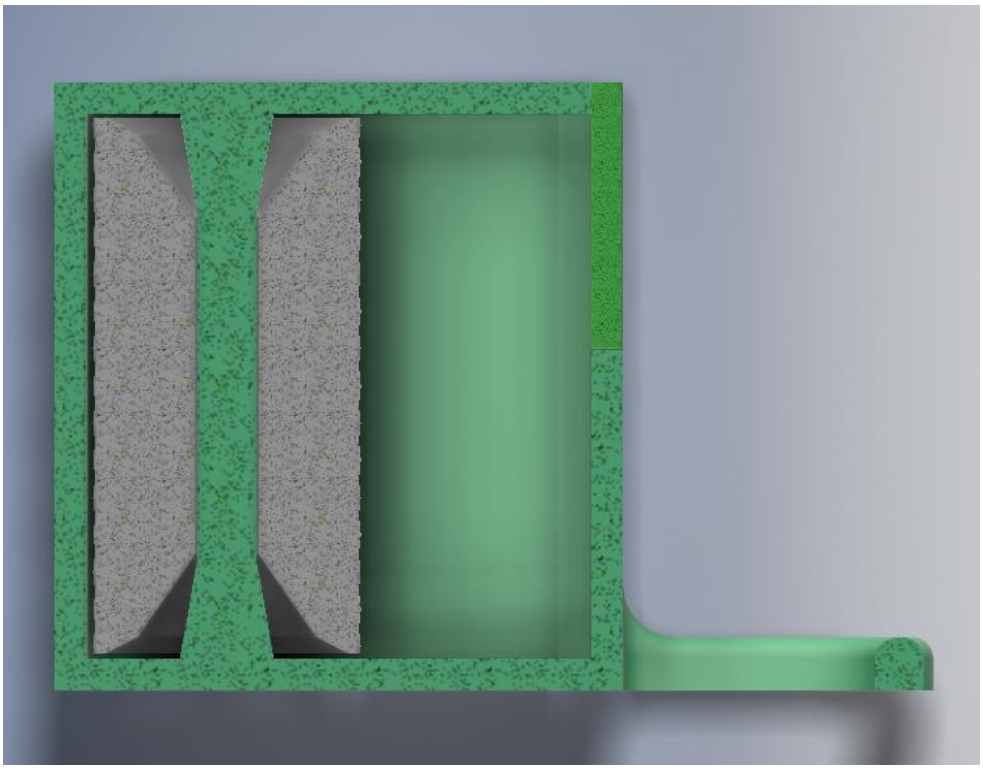
First, I'd change the dimensions of the knurling on the roller. Currently, the knurling is very fine, to the point where it is not rendered properly by the slicer. For future 3D printed iterations, I'd go for a larger knurl pattern, but for injection moulding this might be acceptable. Additionally, I'd increase the tolerance between the roller and the axle, as it took a lot of working-in and lubricant for the roller to spin freely. I also considered using bearings instead for a smoother experience, and to prevent chalk from plugging up the rotation mechanism. This method would be ideal if I were to move away from print-in-place, or switch to injection moulding. Additionally, I found the dovetail/dimple powered door to be quite annoying to operate, and I'd like to find a way to keep it from fully separating from the shell and getting lost. If injection moulding was possible, I'd probably switch to a living hinge. I also found the roller guards protruded too much, I'd probably reduce their profile or remove them all together.

Visualization









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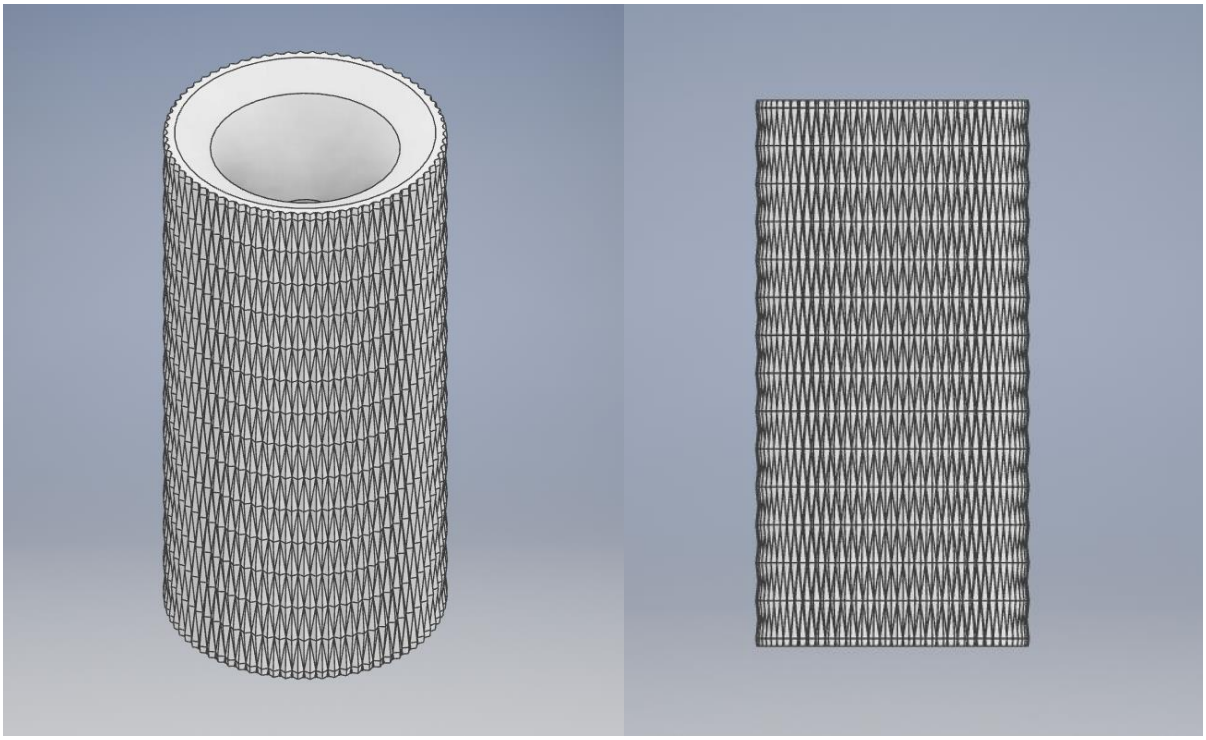
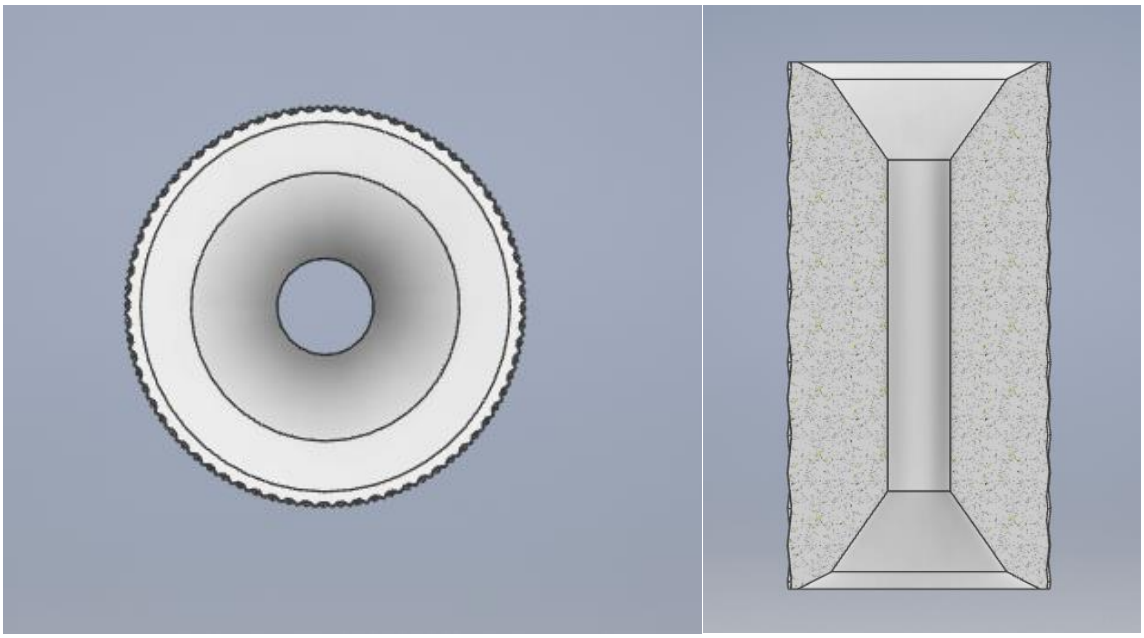
Roller





Door