High Speed 2-Directional 3D Printer

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Abstract

For my capstone project I worked on a small team to develop a novel 3D printer design in which two traditional delta printers are configured horizontally opposed to each other, allowing objects to be printed from two sides simultaneously. Unlike a traditional 3D printer, this setup has no continuous build plate from which to print off of; the two extruders must meet in open space in order to create a single bonded object. Since a print head must extrude onto something to create a viable print, we faced the problem of how to produce an initial rigid 'kernel' for a given 3D model from which the rest of the object could be printed. We ultimately decided to produce this kernel by printing a 'web' of filament inwards from the rim of a ring shaped outer build plate.

A major constraint of this design is that 3D printers can only 'bridge' (print across open air between two fixed points) a limited distance before print quality begins to suffer. However, by utilizing a web composed of a series of nested polygons chosen with a sufficient number of sides, we were able to constrain the maximum length of any printed bridge while ensuring that our kernel pattern can fill any circular print area. We developed code to generate these kernel models with a number of configurable parameters which allow for fine tuning a compromise between structural rigidity and print speed of the kernel. Our generator produces 3D models which can be sliced on an unmodified 3D printer slicer program– a post processing script can then be used to transform the slicer's output into two correct sets of G-code instructions to pass to the two component printers. This system allows for flexibility in the choice of slicer software used.