Abstract

With recent innovations in technology, 3D printing has become a rapidly expanding manufacturing method that is being used for a wide range of applications. Their ability to build parts layer by layer instead of cutting away initial material allows this method to have almost no wasted material, creating the potential for a much more efficient, cost effective process. In order to continue the growth of this manufacturing strategy, the performance of 3D printers need to be enhanced to ensure equal or higher quality of produced parts in comparison to other manufacturing methods that are more commonly used. One important part of the performance that is key to making high quality parts is the stability of the 3D printer's frame. No matter how accurate the printer head is, if the structure moves while the printing process is taking place, the accuracy of the produced will be limited.

A detailed analysis was done to study the base corner bracket of the 3D printer structure that is used in the IME labs so that the part can be redesigned to reduce the frames motion. The original design for this part was 3D printed and was made out of ABS plastic. Even though the part seemed extremely strong, by using simulation software, it was found that while the printer is operating, this part can deform as much as 1.34*10^-4 mm at specific locations. By making this part out of 1/8" steel sheet metal, the same loads would cause this part to deform 1.54*10^-5 mm. This mean that the new design would allow for the deflection of this part to be reduced by almost 90%. This may not seem significant, however, 3D printers are able to print layers that are as thin as .001". To give some perspective, a human hair is approximately .003" thick, so as one could imagine, when dealing with dimensions this small, any amount of improvement is advantageous.

In addition to analyzing the stability, a manufacturing process was established, and a scaling and economic analysis was conducted. The manufacturing process is simple and allows for minimal expertise needed in order to create a function part. Also it was found that with sheet metal only available up to ¼" thick, this design could most likely be used in 3D printers that are twice the size as the one in the IME

labs. Lastly, the sheet metal design proved to be economically justifiable in many ways if produced in large quantities, however, the automation involved with 3D printing would most likely provide benefits that would require a much more detailed manufacturing process to be established to come to any realistic conclusions.