CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
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Project Number
S0302

Project Title
Strength of 3D Printed Interlocking Designs

Abstract

Objectives/Goals
The purpose of this research project was to create interlocking joint designs using a simple, inexpensive 3D printer and materials to demonstrate the possibility of new and stronger designs that can be quickly and easily fabricated by typical household 3D printers. Having effective interlocks allows objects larger than a single build plate area to be printed, providing the ability to create even larger items by interlocking them together into an assembly.

Methods/Materials
The 3D printed specimens were created using a Flash Forge Creator Pro. Each specimen was designed to be 70 mm by 15 mm by 15 mm when connected. Each of the eight designs had five trials. The specimens were tested in tension using a home built system that included a ladder, weights, clamps, and carabiners.

Results
The results showed that the pin and hole type joints out-performed joint designs that depended on friction or the stiffness of the flanges to prevent displacement of the flange while under tensile load. With the exception of the circular joint design and the vertically printed pin design, the designs had low coefficient of variation.

Conclusions/Discussion
The testing demonstrated that the three part pin and hole design was the strongest. Testing also demonstrated and confirmed that parts built in the horizontal direction were stronger than those built in the vertical direction. This data confirms the result from others showing that FDM printing produces weaker properties between build layers (Z-direction) than in the direction of the layers (X-Y direction).

Summary Statement
I demonstrated that the three piece pin design was the strongest 3D printed interlock in tensile load created in this experiment.

Help Received
None. I designed, built, and tested the specimens on my own.