MAKER: Redesign of a Ratchet for Additive Manufacturing

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Abstract

Fused filament fabrication (FFF) is different than other manufacturing methods. In most processes of polymer manufacturing the internal structure of a product is solid filled. However, it does not necessarily have to be solid when a product is 3D printed. It is an advantage of having an infill structure with different densities. The infill density and shell number play a large role in the mechanical properties of the final 3D model. The way in which the pattern is generated influences the mechanical properties of a part as well. The way a slicing program generates the infill pattern is largely based on position and orientation of the part on the print bed. As a result, with similar conditions, mechanical properties can vary greatly based on the initial orientation and the extruder path. In this study, the internal structure of a 3D printed part is parametrically modeled in a CAD system, analyzed with finite element method (FEM) to see the consequences of different internal structures of AM part. FEM simulations of a ratchet design with custom designed infills and walls for FFF has been used to compare the effects of the internal structure to the strength and flexibility.