

## **MAKER: Redesign of a Ratchet for Additive Manufacturing**

**Mr. Daniel David Warfield**

**Dr. Serdar Tumkor, University of Pittsburgh at Johnstown**

Serdar Tumkor is an Assistant Professor of Mechanical Engineering Technology at University of Pittsburgh at Johnstown. Dr. Tumkor has more than 20 years of experience in education, having taught at Stevens Institute of Technology and Istanbul Technical University. His engineering experience includes design, manufacturing, and product development. He has been lecturing Manufacturing Processes, Machine Design, Engineering Design, and Computer Aided Technical Drawing courses.

**Dr. Hugh Jack P.E., Western Carolina University**

Dr. Jack is not an author. The paper has been submitted on behalf of the other authors.

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Daniel Warfield, Dr. Serdar Tumkor  
Mechanical Engineering  
University of Pittsburgh at Johnstown

### **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.