Exploiting design intent to produce failsafe extrusion-based parts.

A. Bailas Konstantinos[1] B. Papanikos Paraskevas[2]

[1]*University of the Aegean, Department of Product and Systems Design Engineering, Konstantinoupoleos 1– 84100 Ermoupoli Syros, Greece, kbail@aegean.gr.*
[2]*University of the Aegean, Department of Product and Systems Design Engineering, Konstantinoupoleos 1– 84100 Ermoupoli Syros, Greece, ppap@aegean.gr.*

Keywords. (additive manufacturing, infill pattern, design intent, failsafe, lattice pattern).

Abstract.

Additive manufacturing (AM) technology is an innovated production process mostly in the field of customization parts that gained the interest of many academics and industries over the last twenty years. The extrusion-based technique and a wide variety of constantly developed polymer materials that AM technology uses, integrates multiple functions and mechanical properties to parts and provides a flexibility in fabrication of complicated shapes, making products attractive to a wide range of applications. The quality and durability of those parts are controlled by numerous of building features that need to be set before building through specialised software that accompanies AM machines [1]. A very crucial building feature that determines the inner structure of parts is lattice structure which is controlled by building parameters such as infill pattern and infill density. Lattice structure proved to determine the strength-to-weight ratio, the minimization of the material, the building time, and the energy absorption of the produced parts [2]. However, lattice structures can be applied only to the entire geometry of the part because AM software have limited capabilities regarding the inner geometry of products since they can't define different shell thickness values to the inner surfaces and multiple geometry lattice pattern to specific areas of the part [3]. The current study proposes a new methodology of controlling the internal geometry of extrusion-based parts, bypassing the low capabilities of AM software using the meaning of design intent to redesign the lattice structure of the internal geometry, applicable to the meaning of failsafe products in industry.

1. Ei Ei Cho1, Ho Hin Hein1, Zarni Lynn1, Saw Jiemie Hla1, and Thanh Tran: Investigation on Influence of Infill Pattern and Layer Thickness on Mechanical Strength of PLA Material in 3D Printing Technology. Journal of Engineering and Science Research 3 (2): 27-37(2019).

2. Amadel Garcis-Dominguez, Juan Claver, Miquel A. Sebastian: Infill optimization for pieces obtained by 3D printing. 8th Manufacturing Engineering Society International Conference. Procedia Manufacturing Volume 41 (2019) 193–199.

3. K Bailas, P Papanikos: Injecting epoxy resin to specially designed voids of additively manufactured parts to improve mechanical properties. 30th International Conference on Flexible Automation and Intelligent Manufacturing (FAIM2021). Procedia Manufacturing Volume 51 (2020) Pages 692-697.