# Minimize the production cost of extrusion-based AM parts by optimizing their internal building geometry.

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## Abstract

The evolution and the establishment of Additive manufacturing (AM) technology in industry over the last decade was aided mostly by new materials which were developed in parallel with advanced AM techniques and machines that use a wide variety of simple or blend polymers and metals. Nevertheless, the future of AM technology is based on the further reduction of production costs as well as the increase of the quality and durability of the produced parts [1]. Although, the durability of AM parts proved to depend mostly on the mechanical properties of the materials and the way their geometry was deployed internally [2], recent studies showed that building parameters such as the infill pattern and the infill density, which were defined through specialised software of AM machines, have a great impact on the total cost and the durability of parts as they shape the internal structure affecting the amount of mass the strength the compression resistance and the stiffness [3]. However, the software that accompanies AM machines have limited capabilities and influence on these parameters since they are not able to define more than one pattern for a part or multiple shell thickness. The current study is concerned with the decrease of the production cost of products made with extrusion-based AM process by minimizing the mass and controlling the durability using the meaning of design intent, while maintaining the quality and the dimensions of the outer surface of parts and allows the creation of heterogeneous objects with new improved internal structure.

### References

[1] Janos Plocher, Ajit Panesar: Review on design and structural optimization in additive manufacturing. Towards next-generation lightweight structures. Journal of Materials and Design: Volume 183(2019).

[2] J M Chacon, M A Caminero, E Garcia Plaza, P J Nunez: Additive Manufacturing of PLA structures using fused deposition modelling-Effect of process parameters on mechanical properties and their optimal selection. Journal of Materials & Design: Volume 124, 143-157(2017).

[3] Harshit K Dave, Naushil H Patadiya, Ashish R Prajapati: Effect of infill pattern and infill density at varying part orientation on tensile properties of fused deposition modeling-printed polylactic acid part. Journal of Mechanical Engineering Science: Volume 235 1811-1827(2019).