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Evaluation of the surface roughness and dimensional accuracy of low-cost 3D-printed parts made of PLA–aluminum

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OPTIMIZING SURFACE QUALITY AND PROCESSING TIME OF 3D PRINTED POLYLACTIC ACID MATERIAL FOR RAPID TOOLING

Prawata, A.A. , Tjandra, S. , Suteja, T.I.

Abstract

Fused deposition modeling (FDM) is currently used in several fields, such as architecture, manufacturing, and medical applications. FDM was initially developed to produce and create prototypes, but the expense appears excessive for producing final products. Nevertheless, in this day and age, engineers have developed a low-cost 3D printer. One of the major issues with low-cost 3D printers is the low dimensional accuracy and high tolerances of the printed products. Herein, different printing parameters, i.e., layer thickness, printing speed, and raster angle, need to be investigated to enhance the surface roughness of the parts produced using FDM. Thus, the present study focuses on investigating the performance of the surface finish produced by FDM by manipulating different parameters such as layer thickness, printing speed, and raster angle. Taguchi's method, based on the L_9 array for experimental design, was employed to elucidate the response variables. The sample model was developed following ISO standards, utilizing polylactic acid (PLA)-aluminum as the filament material. The analysis of variance results indicated that the layer thickness and raster angle significantly affect the surface roughness of the printed parts, with statistical P-values of 0.016 and 0.039, respectively. This enables an easy selection of the optimal printing parameters to achieve the desired surface roughness. The dimensional accuracy of the fabricated part was also evaluated. Thirteen dimensions of the part features were analyzed, and the results showed that the FDM machine exhibited good accuracy for most of the shapes, with a deviation below 5%. © 2024 The Authors

Author keywords

Aluminum composites; Fused deposition modeling; Surface roughness

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Optical investigations of the 3D printing regime influence on surface parameters

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- 1 Holzmann, P., Breiteneker, R.J., Soomro, A.A., Schwarz, E.J.
User entrepreneur business models in 3D printing
(2017) *Journal of Manufacturing Technology Management*, 28 (1), pp. 75-94. Cited 77 times.
<http://www.emeraldinsight.com/info/journals/jmtm/jmtm.jsp>
doi: 10.1108/JJMTM-12-2015-0115

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- 2 Sitotaw, D.B., Muenks, D., Kyosev, Y., Kabish, A.K.
Influence of fluorocarbon treatment on the adhesion of material extrusion 3D prints on textile
(2022) *Journal of Industrial Textiles*, 52. Cited 3 times.
<https://journals.sagepub.com/home/jit>
doi: 10.1177/15280837221137014

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