Optimization of process parameters to improve mechanical properties of fused deposition method using taguchi method

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Aims and scope

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Abstract

Another popular way to make things is with additive manufacturing, which involves adding material layer by layer to make parts. Fused Deposition Modeling is a type of Additive Manufacturing or 3D printing technology that makes the part you want by adding layers of liquid solid material. Using PLA (Polylactic Acid) as the thermoplastic, this method makes it possible to print complicated shapes accurately and with little material. 3D printing has many benefits, but the parts it makes don't have the same surface finish or functional strength as parts made the old way. The study's goal is to look at how different things, like layer thickness, nozzle design, filling percentage, build time, and surface roughness, affect the 3D printed part. To look at these results, the Taguchi

method is used. The Taguchi method, which is also called the sturdy design method, is a powerful way to make goods better. The Taguchi method uses statistics to improve the quality of the result by finding the best settings for the process. Researchers used the Taguchi design of experiments to find the best mix of factors and their amounts for making sample sets. It has not been made public which orthogonal group was picked. Using Taguchi approach, the optimal printing settings for low surface roughness were lines, 90% infill density, and 0.8 mm shell thickness. The ANOVA showed that the infill pattern had the greatest impact on surface roughness and tensile strength, contributing 88.66% and 52.07%, respectively, followed by shell thickness and other process factors. The results show that the filling % had the most significant effect on the storage stiffness and mechanical damping. The opening temperature had the least significant effect. It is suggested that the filling % and valve temperature be raised to get better dynamic mechanical features.

Data availability

No datasets were generated or analysed during the current study.

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Contributions

Jayant Giri, Neeraj Sunheriya: Wrote the paper with input from all authors, Contributed to the design and implementation of research, to the analysis of result and to the writing of the manuscript. T.Sathish, Yash Kadu, A.Parthiban: Contributed to the design and implementation of research. Rajkumar Chadge, Pallavi Giri, Chetan Mahatme: Contributed to the design and implementation of research.

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Ethics declarations

Ethical approval

Not applicable.

Consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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