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SELECTION OF BEST 3D PRINTING PARAMETERS FOR FUSED DEPOSITION MODELING PART USING A NOVEL HYBRID MULTI-CRITERIA OPTIMIZATION TECHNIQUE

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Abstract

One of the most widely used 3D printing techniques is fused deposition modeling (FDM) which builds things layer by layer by dispensing molten materials through a heated nozzle. To showcase the flexibility of 3D printing, test samples were made using polylactic acid (PLA). Trial runs with Taguchi's (L27) orthogonal array were performed. Layer thickness, printing speed, and carbon deposition (C-deposition) were the three input parameters that were improved. This was accomplished by combining principal component analysis (PCA) with multi-objective optimization based on ratio analysis (MOORA) in an integrated approach to multi-criteria optimization. The main goal of this study is to maximize the input parameters for the Industry 4.0 technological production process of embossing components. The MOORA-PCA technique finds the best combinations of process variables; for example, printing at a speed of 75 mm/s, layer thickness of 0.1 mm, and carbon content of 15 mg yield the required results. The results of this study will help production managers and researchers choose the best FDM 3D printing methods for improving mechanical qualities and surface roughness. The economic feasibility of the 3D printing businesses may be strengthened by these research findings, which will benefit customers looking for ecologically friendly items.

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