

A Multi-Criteria Decision Framework for PET-G Additive Manufacturing: Optimizing Process Parameters for Enhanced Tensile and Impact Performance Using TOPSIS and PROMETHEE

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Abstract

Polyethylene terephthalate glycol (PET-G) is a widely used additive manufactured material for industrial applications, particularly in the production of the lightweight Pro model with its intrinsic geometry. High levels of geometric intricacy and remarkable structural strength are possible with techniques for metal 3D printing such as binder jetting,

powder bed fusion, and directed energy deposition. To improve quality and reduce costs, it is essential to select the appropriate process parameters in Rapid Prototyping Machining (RPM). Multi-criteria Decision Method (MCDM) techniques such as TOPSIS and PROMETHEE help to achieve optimal results by analyzing parameters like Infill Density (ID), Layer Height (LH), and Nozzle Temperature (NT) to evaluate mechanical properties, including Ultimate Tensile Strength (UTS), Impact Strength (IM), and Compression Strength (CMPS) in accordance with ASTM standards. To evaluate the results obtained, we utilize the methods mentioned earlier. Among the L27 array, the combination of 42% of ID along with the 2350C NT and 0.2 mm LH has been obtained as the best.

Keywords

Rapid prototyping Machining, TOPSIS, PROMETHEE

Biographies

Dr. Ramesh Raju is an Associate Professor, Department of Mechanical Engineering SRM Institute of Science and Technology (Deemed to be University) - Tiruchirappalli Campus, Tiruchirappalli, India, 2% scientists and Completed his doctoral Programme in NIT, Trichy, and had 130 plus publications.

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