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Investigation of the mechanical behaviour of additively manufactured lattice structures using Smart Design algorithms

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Lattice structures are a class of geometries with highly customizable mechanical properties. The resulting products are characterized by low weight and high mechanical performance, finding increasing applications in several fields such as automotive and biomedical engineering. Furthermore, their complex geometries make them ideal for advanced additive manufacturing. This work aims to investigate the behavior of lattice structures fabricated via Fused Deposition Modeling (FDM). The study is carried out using a custom Smart Design algorithm that integrates finite element analysis, machine learning techniques, and optimization strategies. This framework allows for the rapid exploration of various geometric parameter combinations, quantifying the influence of each input on an objective function, which accounts for both mechanical and energy parameters, to identify the optimal solution. Finally, the results are validated through experimental tests on lattice specimens.

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