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Smart Design algorithms for lattice structures optimization

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Additive manufacturing has represented an important turning point in design and production of mechanical components, enabling the rapid creation of prototypes and finished products with varying degrees of complexity. Lattice structures are intricate, repeating patterns of interconnected struts or nodes, often used in engineering and manufacturing to achieve lightweight yet strong designs. Their mechanical properties are strongly affected by their geometrical features and infill density, which impacts on the component's mass. In the present work, Smart Design algorithms are implemented to investigate the influence of geometrical parameters on a lattice-sandwich structure. Parameters such as skin thickness, number of layers and their orientation with respect to the first layer etc. were sampled with Latin Hypercubic Sampling Method (LHS) to apply machine-learning algorithms for data analysis. Each parameter effect was correlated to the objective function, which takes into account mechanical features and energy parameters. Furthermore, an LCA study was conducted to evaluate the environmental impact of each configuration, in order to find the best solution in terms of sustainable design.

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