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Design and Construction of an Innovative Pavilion Using Topological Optimization and Robotic Fabrication Techniques

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Abstract

This research addresses innovations in building structural components through the generative design technique BESO (Bi-directional Evolutionary Structural Optimization) [1] and the application of robotic fabrication to produce efficient and elegant spatial structures. The innovative pavilion discussed in this paper demonstrates a design process and the ambitions of the research group through a full-scale model of large span spatial structures. The focus of this work is the use of a modified BESO technique to optimize the structure which features branches of various sizes, and then apply 'skin' surfaces according to the direction of the main structure. The innovative methodologies of production, construction and assembling are to ultimately replace welded, forged and cast components by large robotic 3D printed components and bolting methods. The advantages of the new design and construction process are less labour, less joints, shorter assembling time, lower cost & more efficient material usage and more complex & elegant large structural form.

References

[1] X. Huang, Y.M. Xie, *Evolutionary Topology Optimization of Continuum Structures: Methods and Applications,* Wiley, 2010.