Parametric and Generative Design Techniques for Mass-Customization in Building Industry: A Case Study for Glued-Laminated Timber

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Summary:

According to Wortmann classification, the Building Industry (BI) can be defined as engineer-to-order (ETO) industry: the engineering-process starts only when an order is acquired. This definition implies that every final product (building) is almost unique, and processes cannot be easily standardized or automated. For this reason, the Building Industry is one of the less efficient industries today, and the productivity gap with other industries is growing faster. Since the 1940s, prefabrication and standardization of entire buildings or of complex components are effective strategies to push BI from an ETO industry towards an assembly-to-order industry (ATO). Although, prefabrication and standardization strategies provide effective solutions to improve process efficiency, they are not widespread adopted. The reason for this poor success can be identified in limits of customization that afflicts prefabricated and standardized products, which do not satisfy completely the needs usually delivered by customers. This paper presents a research activity aiming at enhancing Mass-Customization capabilities in the BI through Parametric and Generative design techniques in frontend activities of the value-chain system. Referring to a case study for Glued-Laminated Timber (GLT) products, a parametric algorithm has been programmed in order to satisfy two specific design intents: reducing the usage of unneeded high-quality raw material in final products and facilitating the manufacturing process of complex products, such as doubled-curved ones. Crossing capabilities of the parametric algorithm in Digital Fabrication strategies and capabilities of a standard production system of GLT, authors discuss whether Parametric and Generative Design techniques may enhance Mass-Customization capabilities in the BI, pushing the whole production system towards more efficient processes.

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