Digital Design and Robotic Fabrication Strategies for a Timber Tower Structure with Interlocking Joints

Hua Chai, Dario Marino[a], Edmund SO, Philip F. Yuan*

*Tongji University
1239 Siping Rd, Shanghai
Philipyuan007@tongji.edu.cn

[a] University of Pavia
via Ferrata 3, 27100 Pavia
salvatoredario.marino@unipv.it

Abstract

While cutting-edge design and fabrication technologies have strongly promoted the innovation of modern timber architecture, they also contributed to the revival of tradition wood tectonics from different aspects. Traditional tectonics like interlocking joints have also regained the focus of attention, and been redesigned and fabricated for innovative timber construction (Schwinn et al., 2014).

By placing the traditional timber structure, pagoda in this case, under the technical background of digital design and robotic fabrication, this research explores an approach of innovative timber tower structure through the design and construction of a 9-meter-high tower with fully interlocking joints. The research was conducted through a workflow of four parts: the initial phase focused on the analytical study of traditional pagoda structure and joints which provided structural pinciples for further design; a second step was to define innovative prototypes by exploiting the structural principles as generative factors, and optimize the prototypes through structural simulation and experiments; then the third phase try to make innovative tower structural design based on the prototypes and boundary conditions, and optimize the component size through FEM simulation; the last phase regarded the robotic translation of wood crafts through the processing of the components.

The final result is presented as a timber tower structure with a height of over 9 meters. All components of the structure are connected with interlocking joints without using any additional connectors or glue. Both the symmetrical form and timber structure system resemble Chinese traditional pagoda. This research provide an approach for further explored the wealth of knowledge implicit in the historical timber structures in both the East and West.

References

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