

木材横纹受压性能增强及数值模拟研究*

张凤毫¹ 赵丽媛¹ 王斯栋^{1,2} 王钱晴¹ 陈瑞瑶¹ 江京辉¹

(1. 中国林业科学研究院木材工业研究所 北京 100089)

(2. 北京林业大学材料科学与技术学院 北京 100089)

摘 要:【目的】木材是一种典型的各向异性材料,其横纹抗压强度远低于顺纹抗压强度。在木结构设计与建造过程中,由于横纹受压所导致的建筑倾斜甚至坍塌现象普遍存在,目前用于加固的植筋材料多为钢筋或螺钉,且未能分析植筋木材的内力变化。【方法】本研究以日本落叶松为材料,通过植入木销进行增强,探究木销数量、长度对木材横纹抗压强度和弹性模量的影响规律,并采用有限元软件 ABAQUS 建立仿真模型,模拟分析木销植入后试样的应力、应变变化,并预测、模拟木销直径对木材横纹抗压强度和弹性模量的影响。【结果】通过分析显示,木材横纹受压性能随植入木销的长度和数量的增加而增大,而有限元模拟结果则显示,植入木销可以改变木材内部结构的应力、应变分布,且随着木销长度的增加,其上分布的应力和应变逐渐增大,但是当木销长度较短时,仅通过增大木销直径对木材横纹抗压强度和弹性模量的提升有限,当木销长度达到 90 mm 时,改变木销直径能有效提升木材的横纹抗压强度和弹性模量。【结论】通过植入木销可以有效提高木材的横纹受压性能,而有限元数值模拟则为“植筋”技术提供了一定的理论依据。

关键词: 日本落叶松; 横纹抗压强度; 弹性模量; 木销加固; 有限元

中图分类号

文献标识码:

文章编号:

Study on the transverse compression performance of wood reinforced with wood dowels and finite element numerical simulation*

Zhang Fenghao¹ Zhao Liyuan¹ Wang Sidong^{1,2} Wang Qianqing¹ Chen Ruiyao¹ Jiang Jinghui¹

(1. Institute of Wood Industry, China Academy of Forestry, Beijing, 100089)

(2. College of Materials Science and Technology, Beijing Forestry University, Beijing 100089)

Abstract:【Objective】Wood is a typical anisotropic material with considerably lower transverse compressive strength than longitudinal compressive strength. In the field of wooden structure design and construction, the occurrence of tilting or even collapse due to transverse compression is a common challenge requiring careful consideration. Presently, reinforcement materials primarily include steel bars or screws, yet a comprehensive examination of internal force dynamics within reinforced wood is lacking. 【Method】This study utilizes Japanese larch (*Larix kaempferi* (Lamb.) Carrière) as the timber material and enhances the material through the insertion of wood dowels to investigate the impact of the number and length of wood dowels on transverse compressive strength and modulus of elasticity. A simulation model is established using the finite element software to analyze stress and strain variations in samples following wood dowel implantation. The study investigates the predictive and simulated influence of wood dowel diameter on the transverse compressive strength and modulus of elasticity of wood.

【Result】The analysis showed that the transverse compressive performance of wood increases with the increase in the length and number of wood dowels. The finite element simulation results showed that introducing wood

dowels can influence the stress and strain distribution within the internal structure of wood, with increasing trends observed as the length of the dowel increases. However, when the length of the wood dowel is short, increasing the diameter has a limited impact on enhancing the transverse compressive strength and elastic modulus of the wood. However, when the length reaches 90 mm, altering the diameter effectively improves these properties. **【Conclusion】** The transverse compression performance of wood can be effectively improved by implanting wood dowels, and finite element numerical simulation provides a certain theoretical basis for the "planting tendon" technology.

Key words: Japanese larch; transverse compressive strength; modulus of elasticity; wood dowel reinforcement; finite element analysis