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纤维增强聚合物布加固木梁的非线性弯曲分析

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Nonlinear Bending Analysis of Timber Beam Strengthened with Fiber Reinforced Polymer

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摘要 考虑纤维增强聚合物（fiber reinforced polymer,FRP）布加固层拉伸与压缩时的不同弹性模量以及木梁非线性弯曲的二阶变形和轴向拉伸效应，利用摄动法研究均布横向荷载作用下简支FRP布加固木梁的非线性弯曲问题，得到加固木梁的挠度和弯矩等渐近解析表达式，并给出数值分析.结果表明：FRP加固木梁非线性弯曲的挠度和弯矩小于线性弯曲的挠度和弯矩，并且当无量纲荷载小于5时，FRP加固木梁非线性弯曲和线性弯曲的挠度和弯矩几乎相等，没有明显差别；但随着载荷的增大，二者相差逐渐增大；当无量纲载荷大于20时，非线性弯曲效应十分显著，必须选用FRP加固木梁的非线性弯曲模型进行分析.

关键词： 纤维增强聚合物(fiber reinforced polymer,FRP) 非线性弯曲 加固 二阶效应 摄动解

Abstract： Taking into account the effects of bi-modulus for tension and compression of fiber reinforced polymer (FRP) layers and second order deformation and axial tension of the nonlinear bending of a timber beam, nonlinear bending of simply-supported FRP-strengthened timber beams under a uniform transversal load is investigated with the perturbation method. Asymptotic expressions of deflection and bending moments of the FRP-strengthened timber beam are obtained, and numerical results are presented. It is revealed that deflections and bending moments of nonlinear bending of the FRP-strengthened timber beam are smaller than those of linear bending. When the dimensionless load is less than 5, deflections and bending moments of nonlinear and linear bending are almost equal to each others, and there are no distinct differences. The difference between them increases when the load is increased. When the dimensionless load is greater than 20, the effect of nonlinear bending is remarkable, and a model of nonlinear bending of the FRP-strengthened timber beam should be used.

Keywords： fiber reinforced polymer (FRP), nonlinear bending, reinforcement, second order effect, perturbation method

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[1]   莫骄. 木结构设计 [M].北京:中国计划出版社,2006:1-23.

[2]   张青萍， 陈军.中国现代木结构建筑发展之策略[J].中国科学: E辑,2009,39(5):874-877.

[3]　许清风，　朱雷.CFRP维修加固局部受损木柱的试验研究[J].土木工程学报,2007,40(8):41-46.

[4]　周钟宏，　刘伟庆.碳纤维布加固木柱的轴心受压试验研究[J].工程抗震和加固改造,2006,28(3):44-48.

[5]　欧阳煜，　龚勇.碳纤维布加固破损木柱偏心荷载作用下的性能试验[J].上海大学学报: 自然科学版,2012,18(2):209-213.

[6]　邵劲松，　刘伟庆,蒋桐,等.FRP加固轴心受压木柱应力-应变模型[J].工程力学,2008,25(2):183-187.

[7]　PLEVRIS N, TRIANTAFILLOU T. FRP-reinforced wood as structural material [J]. Journal of Materials in Civil Engineering, 1992, 4(3):300-317.

[8]　TRIANTAFILLOU T. Shear reinforcement of wood using FRP materials [J]. Materials in Civil Engineering, 1997, 9(2):65-69.

[9]　MANALO A C, ARAVINTHAN T, KARUNASENA W, et al. Flexural behaviour of structural fibre composite sandwich beams in flatwise and edgewise positions [J]. Composite Structures, 2010, 92(4):984-995.

[10]　CORRADI M, BORRI A. Fir and chestnut timber beams reinforced with GFRP pultruded elements [J]. Composites Part B: Engineering, 2007, 38 (2):172-181.

[11]　杨会峰，　刘伟庆,邵劲松,等.FRP加固木梁的受弯性能研究[J].建筑材料学报,2008,11(5):591-597.

[12]　KIM Y J, HARRIES K A. Modeling of timber beams strengthened with various CFRP composites [J]. Engineering Structures, 2010, 32(6):3225-3234.

[13]　FIORELLI J, DIAS A A. Glulam beams reinforced with FRP externally-bonded: theoretical and experimental evaluation [J]. Materials and Structures, 2011(44):1431-1440.

[14]　OUYANG Y, YANG X, BAO R H. Nonlinear stability of timber column strengthened with fiber reinforced　polymer [J].　Applied Mathematics and Mechanics, 2011, 32(7):903-916.

[15]　TAHERI F. NAGARAJ M, KHOSRAVI P. Buckling response of glue-laminated columns reinforced with fiber-reinforced plastic sheets [J]. Composite Structures, 2009, 88(3):481-490.

[1]　欧阳煜,李游.CFRP布加固圆形木梁抗弯性能的试验[J]. 上海大学学报(自然科学版), 2012,18(5): 545-550

[2]　欧阳煜 杨骁 包若涵.Nonlinear stability of timber column strengthened with fiber reinforced polymer[J]. 上海大学学报(自然科学版), 2011,32(7): 903-916

[3]　叶红义1,陈永秀2.碳纤维布加固混凝土梁支座负弯矩区的试验[J]. 上海大学学报(自然科学版), 2009,15(1): 105-110

　　刘涛;冯伟;张智梅;欧阳煜 .

[4]　新FRP技术加固钢筋混凝土矩形柱改善延性的试验研究
[J]. 上海大学学报(自然科学版), 2008,12(1): 7-14