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U肋加劲板焊接残余应力数值模拟分析

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NUMERICAL ANALYSIS OF WELDING RESIDUAL STRESS OF U-RIB STIFFENED PLATE

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摘要

通过数值模拟和实验方法对U肋加劲板焊接残余应力进行了估算和分析,建立了三维热弹塑性有限元模型,采用生死单元法模拟焊缝填充和焊接热输入过程,实现了整个焊接过程中的动态应力和变形变化,得到了U肋加劲板的焊接温度场和应力场,分析了U肋加劲板的焊接残余应力分布,并与残余应力测试试验结果比较.结果显示:U肋加劲板近焊缝区残余拉应力达到材料屈服强度,母板远离焊缝区残余压应力平均值约为材料屈服强度的0.2倍,其分布趋势与实验测试得到的残余应力分布比较接近,证明了所采用的焊接数值模拟方法的正确性.

关键词: 钢桥 焊接残余应力 数值模拟 U肋加劲板 热力学 焊接

Abstract:

In order to take into account the change of stress and deformation during the whole process of welding and the thermal field distribution of a U-rib stiffened plate, a thermal elastic-plastic FEM model was adopted and element birth and death was used to simulate the weld seam fill-in and heat input. And the residual stress distribution was investigated by numerical simulations and experiments. The comparison of numerical analyses and experimental results of distribution and magnitude of residual stress showed that residual stress near the weld seam is close to material yielding stress, the average value of the residual stress far from weld seam on the mother board was around 0.2 time of material yielding stress. The residual stress distribution tendency derived from numerical simulation was close to the experiment result, which proved the validity of the numerical simulation.

Key words: steel bridge residual stress numerical simulation U-rib stiffened plate thermodynamics weld

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[1]

[1] D. 拉达伊. 焊接热效应[M]. 熊第京, 郑朝云, 史耀武, 译. 北京: 机械工业出版社, 1997: 8-12. Dieter Radaj. Heat effects of welding [M]. Translated by Xiong Dijing, Zheng Zhaoyun, Shi Yaowu. Beijing: China Machine Press, 1997: 8-12. (in Chinese)

[2]

[2] 北田俊行, 中井博, 古田富保. 閉断面補剛材を有する鋼板の初期不整に関する研究[J]. 土木学会論文集, 1991, 428(I-15): 127-136. Toshiyuki Kitada, Hiroshi Nakai, Tomiyasu Furuta. A study on initial deflections and residual stresses in steel plates with closed cross-sectional stiffeners [J]. Proceedings of the Institution of Civil Engineering, 1991, 428(I-15): 127-136. (in Japanese)

[3]

[3] 大橋治一, 依田照彦, 樋口康三. 長大斜張橋鋼床版の初期不整の実測データとその圧縮強度の評価[J]. 土木学会論文集, 1996, 549(I-37): 55-64. Harukazu Ohashi, Teruhiko Yoda, Kozo Higuchi. Initial imperfection data and evaluation of compressive strength of orthotropic steel deck for long-span cable-stayed bridges [J]. Proceedings of the Institution of Civil Engineering, 1996, 549(I-37): 55-64. (in Japanese)

[4]

[4] 吴冲, 赵秋, 顾晓毅. 钢桥U肋加劲板焊接残余应力试验研究[C]. 哈尔滨: 2009先进焊接与连接学术会议暨第一届焊接高层论坛, 2009: 521-526. Wu Chong, Zhao Qiu, Gu Xiaoyi. Experimental study of welding residual stress of U-shaped stiffened plates of steel bridges [C]. Harbin: 2009 advanced welding and joint conference — welding summit forum, 2009: 521-526. (in Chinese)

[5]

[5] 张彦华. 焊接力学与结构完整性原理[M]. 北京: 北京航空航天大学出版社, 2007: 89-94. Zhang Yanhua. Weld mechanical and principle of structure integrality [M]. Beijing: Beijing University of Aeronautics and Astronautics Press, 2007: 89-94. (in Chinese)


[6]

[6] 汪建华. 焊接数值模拟技术及其应用[M]. 上海: 上海交通大学出版社, 2003: 16-20. Wang Jianhua. Technology and application of welding numerical simulation [M]. Shanghai: Shanghai Jiaotong University Press, 2003: 16-20. (in Chinese)


[7]

[7] En1993-2:2006. Eurocode 3: Design of steel structures- Part 2: Steel bridges [S]. Brussels, Standardisation E C F, 2006.


[8]

[8] Teng T L, Lin C C. Effect of welding conditions on residual stresses due to butt welds [J]. International Journal of Pressure Vessels and Piping, 1998, 75(12): 857-864. 


[9]

[9] Deng D. FEM prediction of welding residual stress and distortion in carbon steel considering phase transformation effects [J]. Materials and Design, 2009, 30(2): 359-366. 

[10]

[10] Deng D, Murakawa H. Prediction of welding distortion and residual stress in a thin plate butt-welded joint [J]. Computational Materials Science, 2008, 43(2): 353- 365. 

[11]

[11] Chen S J, Yang K C. Inelastic behavior of orthotropic steel deck stiffened by U-shaped stiffeners [J]. Thin-Walled Structures, 2002, 40(6): 537-553. 

[1] 沈峰, 章青, 黄丹, 赵晶晶. 冲击荷载作用下混凝土结构破坏过程的近场动力学模拟[J]. 工程力学, 2012, 29(增刊I): 12-15.

[2] 刘铁林, 栾宇, 钟伟. 土-建筑群动力相互作用的数值模拟[J]. 工程力学, 2012, 29(增刊I): 53-56.

[3] 黄林, 廖海黎. H型断面渐近发散振动气动力特征的数值模拟研究[J]. 工程力学, 2012, 29(增刊I): 194-200.

[4] 戴耀, 种肖, 董耀国. 刚塑性扁球壳受弹体冲击时动力学响应的近似解[J]. 工程力学, 2012, 29(9): 75-79.

[5] 王鹏, 邹正平, 刘斌, 叶建, 周志翔, 李维. 雷诺数对涡轮叶片换热影响的研究[J]. 工程力学, 2012, 29(9): 349-358.

[6] 李强, 王伟, 韩现民. 压缩荷载下闭合斜裂纹的分支裂纹渐近扩展分析[J]. 工程力学, 2012, 29(9): 223-229.

[7] 张广, 于开平, 周景军. 通气空泡重力效应三维数值仿真研究[J]. 工程力学, 2012, 29(8): 366-371,384.

- [8] 赵利华, 张开林. 一种新型固有应变法的焊接变形仿真[J]. 工程力学, 2012, 29(8): 33-38.
- [9] 史宝军, 季家东, 杨廷毅. 粗糙度模式对硬盘气膜承载特性的影响[J]. 工程力学, 2012, 29(8): 313-318.
- [10] 李亮, 曾忠, 姚丽萍, 陈朝波, 陈景秋. 组合线圈磁场下的液桥热表面张力流[J]. 工程力学, 2012, 29(8): 39-44.
- [11] 喻葭临, 于玉贞, 张丙印, 吕禾. 基于扩展有限元方法的Carsington坝失稳过程分析[J]. 工程力学, 2012, 29(8): 180-183.
- [12] 石永久, 王萌, 王元清. 钢框架不同构造形式焊接节点抗震性能分析[J]. 工程力学, 2012, 29(7): 75-83.
- [13] 蔡小宁, 孟少平, 孙巍巍, 吴京. 顶底角钢连接半刚性钢结构抗震性能数值分析[J]. 工程力学, 2012, 29(7): 124-129,146.
- [14] 郑山锁, 侯丕吉, 张宏仁, 王斌, 于飞, 国贤发. SRHSHPC框架结构地震损伤试验研究[J]. 工程力学, 2012, 29(7): 84-92.
- [15] 吴韶华, 张健. 各向同性衰变湍流的直接数值模拟研究[J]. 工程力学, 2012, 29(7): 17-23.

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