



一种新型固有应变法的焊接变形仿真

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NUMERICAL SIMULATION OF THE WELDING DEFORMATION BASED ON A NEW INHERENT STRAIN METHOD

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摘要

以T形焊接接头为算例, 结合热弹塑性有限元法和映射应变分量法研究角焊缝角变形的产生机制, 认为固有剪切应变才是产生角变形的主要根源, 而不是传统思维认为的横向固有正应变. 随后, 以此观点为基础, 对比分析了两种不同的加载方位对横向约束度、横向固有应变及残余角变形的影响. 沿焊缝表面斜向加载更接近于实际测量值和热弹塑性模拟值, 表明了此种加载方位的合理性, 为更合理的利用固有应变法预测焊接残余变形提供了有益的参考.

关键词: [焊接残余变形](#) [固有应变](#) [约束度](#) [数值仿真](#) [角焊缝](#)

Abstract:

Take a welded T-joint as example, the formation mechanism of angle distortion of fillet weld was studied by combining thermal elastic plastic analysis with mapping strain component method. The results show that the main source of angle distortion of fillet weld is the inherent shear strain instead of the transverse inherent normal strain. Then, based on the view, two different loading directions that influence transverse restraint degree, transverse inherent strain and residual angle distortion were analyzed. The result made by the diagonal load along the weld surface is closer to the measured values and the thermal-elastic-plastic simulated values, which indicate the rationality of the diagonal loading along weld surface. This paper provides beneficial reference for more rational utilization inherent strain predicting weld residual deformation.

Key words: [welding residual deformation](#) [inherent strain](#) [restraint degree](#) [numerical simulation](#) [fillet weld](#)

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[1]

[1] Ueda Y, Kim Y C, Yuan M G. A prediction method of welding residual stress using source of residual stress (Report I) — Characterstice of inherent strain (source of residual stress) [J]. Transactions of JWRI (Japanese Welding Research Institute), 1989, 18(1): 135-141.

[2]

[2] 周宏, 罗宇, 蒋志勇, 等. 大型船舶结构焊接变形固有应变法预测研究[J]. 江苏科技大学学报(自然科学版), 2010, 24(2): 134-138. Zhou Hong, Luo Yu, Jiang Zhiyong al. Prediction of welding deformation of large complicated structure based on inherent strain methods [J]. Journal of Jiangsu University of Science Technology (Natural Science Edition), 2010, 24(2): 134-138. (in Chinese)


[3]

[3] Xu Lin, Yan Renjun. Inherent shear strain method for forecasting fillet weld' s angular distortion [J]. Journal of Ship Mechanics, 2007, 11(6): 895


[4]

[4] 汪建华, 陆皓, 魏良武. 固有应变有限元法预测焊接变形理论及其应用[J]. 焊接学报, 2002, 23(6): 36-40. Wang Jianhua, Lu Hao, Wei Liangwu. Prediction of weld distortions based on theory of inherent strain by fem and its application [J]. Transactions of the China Welding Institution, 2002, 23(6): 36-40. (in Chinese)

[5]

[5] 罗宇, 鲁华益, 朱积锋. 固有应变的概念及其在船舶建造中的应用[J]. 造船技术, 2005, 264(2): 35-39. Luo Yu, Lu Huayi, Zhu Zhifeng. The concept of inherent strain and its application to shipbuilding [J]. Shipbuilding Technology, 2005, 264(2): 35-39. (in Chinese) 

[6]

[6] Sutoh K, Terasaki T. Effect of welding conditions on welding deformations in welded structural materials [J]. Journal of the Japan Welding Society 1976, 45(4): 302-314. 

[7]

[7] Jang C D, Lee C H, Ko D E. Prediction of welding deformations of stiffened panels [J]. Proceedings of the Institution of Mechanical Engineers, 1999 (12): 361-374.

[8]

[8] 李鸿. 基于固有应变的船体分段焊接变形预测[D]. 哈尔滨: 哈尔滨工程大学, 2006. Li Hong. Prediction of welding deformations of ship structures based on inherent strain [J]. Harbin: Harbin Engineering University, 2006. (in Chinese)

[9]

[9] Seung II Seo, Chang Doo Jang. A study on the prediction of deformation of welded ship structures [J]. Journal of Ship Production, 1999, 15(2): 7


[10]

[10] Lee C H. Prediction of welding deformation of ship hull panel blocks using equivalent loading method based on inherent strain [D]. Seoul: Seoul National University, 2002.


[11]

[11] 徐琳, 严仁军, 龚静. 角焊缝角变形的产生机制与固有剪切应变分量的双抛物面分布模型[J]. 华中科技大学学报, 2007, 24(4): 88-91. Xu Lin, Yan Renjun, Gong Jing. Forming mechanism of fillet weld' s angular distortion and double paraboloid distribution model of inherent shear strain component [J]. Journal of Huazhong University of Science and Technology, 2007, 24(4): 88-91. (in Chinese)

[12]

[12] 游敏, 郑小玲, 余海洲. 关于焊接残余应力形成机制的探讨[J]. 焊接学报, 2003, 24(2): 51-54. You Min, Zheng Xiaoling, Yu Haizhou. Discussion and investigation mechanism of welding residual stresses in mild steel [J]. Transactions of the China Welding Institution, 2003, 24(2): 51-54. (in Chinese) 

[13]

[13] 李鸿, 任慧龙. 船体分段焊接变形仿真[J]. 船舶工程, 2006, 28(5): 19-22. Li Hong, Ren Huilong. Simulation of welding deformations of ship sections [J]. Ship Engineering, 2006, 28(5): 19-22. (in Chinese) 

[1] 王登峰, 王元清, 石永久, 戴海金. 电除尘器壳体墙板立柱结构体系缺陷敏感性研究[J]. , 2012, 29(5): 78-85,106.

[2] 王云, 郑小平, 黄拳章. 飞机越界阻滞过程中乘客安全性分析[J]. 工程力学, 2012, 29(11): 339-343.

- [3] 向敏;吴雄;张为华;王中伟. 超空泡航行器三维流场仿真及性能分析[J]. , 2011, 28(2): 217-222.
- [4] 王荣;魏德强. 渗出对植物细胞穿刺力学行为的影响[J]. , 2009, 26(8): 179-183.
- [5] 刘宁;张相炎. 再生式液体发射药火炮喷雾燃烧理论及数值仿真[J]. , 2009, 26(3): 224-228.