Title: Experimental and Computational Analysis of Residual Buckling Distortion of Bead-on-plate Welded Joint

Authors: Jiangchao Wang, Xianqing Yin, Hidekazu Murakawa

PII: S0924-0136(13)00054-X
DOI: http://dx.doi.org/doi:10.1016/j.jmatprotec.2013.02.009
Reference: PROTEC 13628

To appear in: *Journal of Materials Processing Technology*

Received date: 16-10-2012
Revised date: 19-1-2013
Accepted date: 16-2-2013

Please cite this article as: Wang, J., Yin, X., Murakawa, H., Experimental and Computational Analysis of Residual Buckling Distortion of Bead-on-plate Welded Joint, *Journal of Materials Processing Technology* (2013), http://dx.doi.org/10.1016/j.jmatprotec.2013.02.009

Experimental and Computational Analysis of Residual Buckling Distortion of Bead-on-plate Welded Joint

Jiangchao Wang[1], Xianqing Yin[2] and Hidekazu Murakawa[3]
[1] Graduate School of Engineering, Osaka University, 2-1 Yamadaoka Suita, Osaka 565-0871, Japan
[2] School of Material Science and Engineering, Xi'an Jiaotong University, 28 Xianning West Road, Xi'an, Shaanxi, 710049, P. R. China
[3] Joining and Welding Research Institute, Osaka University, 11-1 Mihogaoka Ibaraki, Osaka 567-0047, Japan

Abstract:
A test specimen with a thickness of 2.28mm was selected as the examined object, to investigate welding induced buckling. Bead-on-plate welding was conducted on the test specimen and residual buckling distortion was observed. A thermal-elastic-plastic (TEP) FE analysis using solid elements model was carried out to predict welding induced buckling after cooling. The inherent deformation of the examined welded joint was also evaluated from the computed results of TEP FE analysis. A shell elements model of the test specimen was used for eigenvalue and elastic FE analyses based on the inherent deformation theory. Eigenvalue analysis predicted the buckling mode and corresponding tendon force in the examined welded joint. Considering large deformation and initial deflection, an elastic FE analysis was carried out to predict the out-of-plane welding distortion, which showed a good agreement with measured distortion.
The generation mechanism of buckling in bead-on-plate welded joint was clarified employing the inherent deformation theory. The tendon force (longitudinal inherent shrinkage) is the dominant reason to produce buckling and the disturbance (initial deflection or inherent bending) triggers buckling but does not influence the buckling mode.

Keywords: Buckling Distortion, Large Deformation, Eigenvalue Analysis, Elastic Welding Analysis, Inherent Deformation Theory, Tendon Force

*Corresponding author: Jiangchao Wang
E-mail: WangJiangchaocn@gmail.com
Tel: +81 060 68798645. Fax: +81 060 68798645