The Finite Element Analysis of Welding Effect on Curtain Wall Joints of Shenzhen Ping An Financial Center

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Abstract

Welding residual stress has an important influence on the performance of welded components, which is directly related to the quality of the project and the safety of the structure. For loaded structures, it is generally necessary to avoid re-welding. Otherwise, the changes of the temperature and stress fields during the welding need to be investigated so as to ensure the performance of the structure[1].

In Shenzhen Ping An Financial Center, the connectors attached to the columns and beams need to be welded to the loaded main structures, since the glass curtain wall cannot be installed during the construction of the main structure. In the welding process, the balance of the welding residual stress is affected by the different members around the joint[2]. In this paper, three types of three-dimensional finite element models of curtain wall joints are developed by MSC.MARC. Based on the thermoplastic theory, the temperature and the stress fields of the curtain wall joints during the welding process are numerically analyzed. The distribution and the value of the welding residual stress and the area affected by this stress are achieved. These provide references for considering the influence of wielding residual stress on the loaded structures in similar cases.

Ping An Financial Center is shown in Fig.1 and the typical anlyitcal resluts are presented in Fig.2.

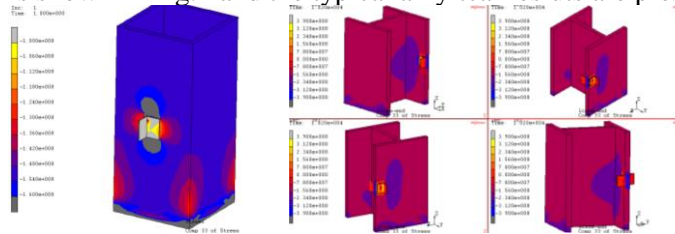Fig.1   Fig.2

According to the finite element analysis, the following conclusions are achieved as following:

(1) The area affected by the welding residual stress of the curtain wall joints is limited, which is mainly around the welds within 60mm. It is worth noting that the maximum value of the local residual stress is close to the yield stress of the steel. (2) The depth affected by the fillet weld to the steel plate is about 4mm. Since both the thicknesses of the steel plate and the weld are 5mm, and the local section is therefore strengthened. The welding residual stress does not influence the stress distribution, the stiffness and the bearing capacity of the overall structure. (3) The research results of this paper provide significant references for determining the curtain wall joints welding effect in the project of Ping An Financial Center.

References

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[2] H D.Hibbitt and P V. Marcal, A numerical thermo-mechanical model for the welding and subsequent loading of a fabricated structure, *Computers and Structures*, 1973, 3(5):1145-1174.