**UNIVERSITI TEKNOLOGI MARA**

# WELDING DESIGN AND DISTORTION ANALYSIS USING FEM, ANALYTICAL AND EXPERIMENTAL STUDY

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# ABSTRACT

This thesis presents the welding design and distortion analysis of low carbon steel due to the emphasizes on the basic principle of welding design and reliability of the welded joint using the finite element method (FEM). Various case studies were conducted starting with the basic welding structure of butt and T-joint which is considered as the preliminary study to explore the capabilities of the numerical model. Further, the study was continued on the complexd t-joint for weld stress and throats thickness determination and distortion analysis on butt joint have been investigated respectively. Finally, all the obtained results were compared and validate using analytical calculation and experimental verification. In the simulation study, welding stress was analyzed using open source FEA and FE general purpose software package ABAQUS 6.10 to obtain a suitable weld throat thickness based on the simulation result. Prediction of distortion analysis has been conducted by using FE commercial software package WELD PLANNER 2010 and SYSWELD 2010. For verification purposes, the analytical calculation was employed to verify both results from the simulation analysis. The series of experiments have conducted to analyze the weld profile using GMAW fully automated robotic welding process. As a result of the welding structure design, about 97.80 MPa and 78.70 MPa have obtained from the simulation analysis of Z88 AURORA and ABAQUS respectively. However, results from WELD PLANNER shown 0.90 mm and SYSWELD represents 0.93 mm for distortion analysis. All the results showed reasonably closed with the analytical calculation and experimental verification. Therefore, simulation analysis indicates a reliable tool for weld stress and distortion prediction of these particular geometry and welding joints used in this study and it was a considerable factor due to distortion analysis in order to minimize and recognizing the structural problem.

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