Numerical Simulation of Residual Stresses in Multi-pass MMAW Butt Welded Plates.

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ABSTRACT

Arc welding induced residual stresses are one of the critical issues in weld structures. These residual stresses may cause brittle fracture or premature failures of weld structures. If the magnitude of them is known before the welding, the preventive measures can be taken at the design stage of the product. Accordingly, in this paper, numerical model is proposed to predict the magnitude of the residual stresses in butt welds. A 3-D coupled Finite Element Analysis (FEA) is used to predict the residual stresses. Element birth and death technique is used to simulate the real life weld phenomenon of the addition of feeler material. The FEA model is validated though the series of shop floor experiments using Manual Metal Arc Welding. The X-Ray Diffraction technique is used to measure the residual stresses in butt welds. The tensile residual stresses of the order of 115 Mpa found in the butt welds. It is also observed that, the predicted and measured results have shown the variation within 10%, showing the ability of the developed FEA model for predicting future residual stresses.

**Keywords**: Residual stresses, numerical simulation, element birth and death technique, X-Ray diffraction, Manual Metal Arc Welding.