

RESIDUAL STRESS EFFECTS ON FATIGUE LIFE OF WELDED STRUCTURES USING LEFM

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In this paper a welding simulation procedure is developed using the FE-software ANSYS in order to predict residual stresses. The procedure was verified with temperature and residual stress measurements found in the literature on multi-pass butt welded plates and T-fillet welds. The predictions show qualitative good agreement with experiments. The welding simulation procedure was then employed on a welded ship engine frame box at MAN B&W. A subroutine for LEFM analysis was developed in 2D in order to predict the crack path of propagating fatigue cracks. The objective was to investigate fatigue test results from special designed test bars from the frame box where all test failed from the non-penetrated weld root. A subroutine was developed in order to incorporate the predicted residual stresses and their relaxation during crack propagation by isoparametric stress mapping between meshes without and with cracks, respectively. The LEFM fatigue life predictions shows good agreement with the fatigue test result when the residual stresses are taken into account in the crack growth analysis.

Keywords: Welding simulation, FEM, residual stresses, fatigue crack growth, linear elastic fracture mechanics.

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