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LOCAL STRAIN APPROACHES FOR LCF LIFE PREDICTION OF SHIP WELDED JOINTS

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Welded joints in ship structures are subject to several variable loadings which may lead to fracture after a relatively low number of cycles. This behaviour is not always fully described by high-cycle fatigue predictions, so low-cycle fatigue has also to be assessed, considering plastic deformation. Local approaches, mainly based on local displacement and strain measurements by strain gauges, are applied in these cases. These approaches have physical limitations when high stress concentrations regions are analyzed.
The aim of this research activity is to predict the low-cycle fatigue life of welded joints used for ship structures, applying two methods: the effective notch strain approach and the structural strain approach. The first method was applied performing elastic-plastic finite element analyses (FEA), using different cyclic stress-strain curves for base material, heat affected zone and weld metal, while the second method requires only elastic finite element analysis and is mesh insensitive. The geometry used for the elastic-plastic finite element analysis was acquired by means of a 3D scanner. The finite element analyses were validated by the experimental data. Effective notch strain results and structural strain results were compared and their values were used to predict fatigue life.

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