

# **“Residual Stress Relaxation in Welded Joints under Static and Cyclic Loading”**

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Weld fatigue strength is currently the bottleneck in designing high performance and lightweight welded structures using advanced materials. Increased material utilization has necessitated increased consideration of the fatigue problem. In order to achieve a fatigue resistant welded structure, it is necessary to manage and control welding process related factors which reduce the fatigue strength of the welded structure and may lead to premature fatigue failures. These factors are sometimes present as welding defects and sometimes as inevitable and unwanted geometrical and metallurgical changes of the materials involved in the welding process. Beside material properties, loading condition, environmental aspects, geometrical features e.g. toe radius and angle, weld defects, it is well known that the influence of welding residual stresses should be taken in to consideration. The extent of the influence of the residual stresses on fatigue life is a matter of debate. Some researchers neglect the influence of the residual stresses in a case of a high quality weld and some respects the significance of the residual stresses on the fatigue strength. The uncertainty of residual stress effects on fatigue is based on the lack of knowledge in the behaviour of residual stress field. So far little information is available on the relaxation and redistribution of welding residual stress field under different types of loading e.g. thermal, static, cyclic and impact and also on the influence of the relaxation and redistribution on fatigue crack growth rate and propagation.

In this work welding residual stress behaviour in welded S235 and S355 steel specimens under static and cyclic loading were studied and the correlation between the relaxation and redistribution of the stress field and materials mechanical properties were studied. As it is known the assembly of welded components introduces residual stresses due to welding sequences and imperfect fit up which could be as detrimental as those induced by welding. In order to study these residual stresses, welding specimen were constrained in the middle of a 2 meter long I-beam during welding and kept constrained during four-point bend loading and the residual stress relaxation in these specimens were investigated.