

Abstract

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Detection of Residual stresses Using the acoustic emission technique

Residual stresses can be defined as the “locked-in” stresses that exist in material structures, independent of the presence of any external loads. Residual stresses develop due to welding are stresses which arise due to uneven cooling and are defined as internal stresses in an externally unloaded member and are therefore in internal Equilibrium at any cross-section. Residual Stresses may be determined either computationally (i.e. using software packages) by applying FE analysis to simulate the cause of Residual stresses experimentally, the common method. Measuring techniques of residual stresses are classified as destructive, semidestructive and non-destructive techniques. T-sections are widely used in many structures such as (i.e. bridges, offshore platforms and marine vessels).welding is considered as the common method for joining metallic plates. The local heating during welding and uneven cooling that follows produces residual stresses. Acoustic emission (AE) is well known technique used for monitoring cracks, corrosion but only few researchers have presented the AE as a technique for measuring the residual stresses in materials. Two series of experiments (i.e. static and dynamic tests) were carried out on welded T-section beams. Four different welding sequences have been applied to generate different values of residual stresses. The raw AE signal was analyzed in time and frequency domains. The main target of this research is to correlate AE parameters (Energy, counts, and hits) to the residual stresses devolved in metal structure due to welding.