Abstract

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Acoustic emission method for defect detection and identification in carbon steel welded joints

Detecting welding defects in industrial equipment (welded joints and built-up structures) is a key aspect in evaluating the probability of failure in different situations. Acoustic emission (AE) is an effective non-destructive detecting technique, and can be a promising application for welding defect detection. This work presents a systematic experimental investigation on using AE technique for detecting and classifying different weld defects in carbon steel joint material. Four certified carbon steel samples were used in this study. A defect free control sample was used as the reference and three samples with induced defects, namely slag, porosity and crack. A pencil lead break (PLB) test was used to generate simulated AE sources on one side of the joint whereas the AE sensor was mounted on the other side to capture AE signals. A total of four experimental arrangements were used to investigate the effect of propagating distance (sensor to source distance) on the ability of AE to detect and identify defects in welds. For each of these arrangements, AE features such as peak amplitude, rise time, decay time, duration, and count numbers along with statistical features such as AE energy, root mean square (RMS) were extracted and analysed. Also, frequency analysis using FFT and wavelet transform were investigated for each weld test specimen for all arrangements. The results show that AE energy, peak amplitude and RMS value can be used to automatically detect and identify the presence of a defect in carbon steel welds. It is concluded that AE has a considerable potential in use in welding inspection to assess the overall structural health and identify defects that can significantly reduce the strength and reliability of welded material and consequently reduce the risk of component's failure.